Spectrophotometer User Guide

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269-220300, Rev. A

Contents

Introduction

This manual explains how to operate the following spectrophotometers:

- Helios™ Zeta
- Helios™ Omega
- Evolution™ 160
- BioMate™ 6
- UV-10
- AquaMate™ Vis
- AquaMate™ Plus UV-Vis

All of these instruments can be run from the integral keypad and LCD display, or from an external computer (additional software is required).

Each system is comprised of a spectrophotometer with integral keypad, LCD display with adjustable contrast, and embedded Local Control Software, plus two USB ports for connecting an external memory device and printer.

Note A USB memory device ships with each system. ▲

The embedded Local Control software controls all aspects of the system's operation. You can collect data at fixed wavelengths, at all points in a spectral range, at one location over a period of time, or run quantitative experiments. The Local Control software includes our UV*calc* application which automatically calculates results from measurements using user-defined equations in Scan, Fixed and Quant modes.

Conventions used in this manual

This manual includes safety precautions and other important information presented in the following format:

Note Notes contain helpful supplementary information. ▲

Notice Follow instructions labeled "Notice" to avoid damaging the system hardware or losing data. ▲

⚠ Caution Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. ▲

Questions or concerns

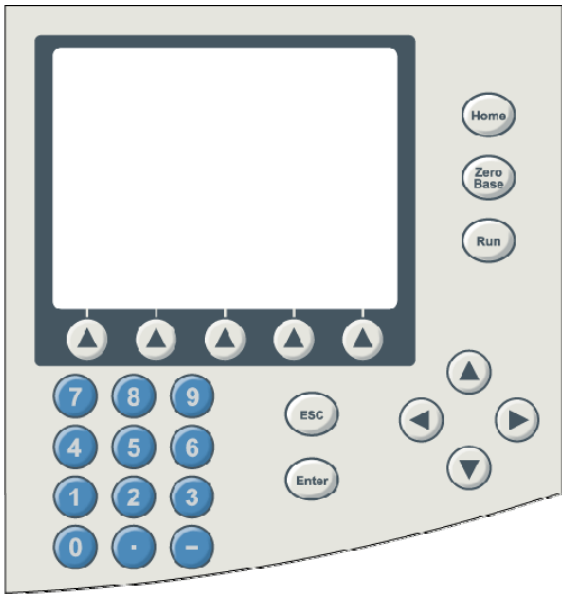
In case of emergency, follow the procedures established by your facility. If you have questions or concerns about safety or need assistance with operation, repairs or replacement parts, you can contact our sales or service representative in your area or visit our web site at www.thermo.com/spectroscopy.

Spectrophotometer Basics

This chapter describes the major components of your spectrophotometer.

Keypad and LCD display

To adjust the contrast for the LCD display, press *Home* and then press the left or right arrow key.



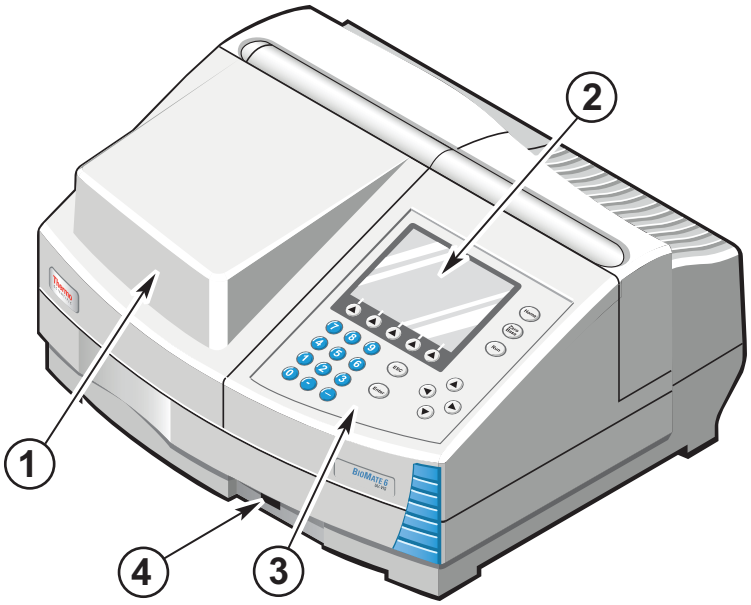
Keypad and LCD display

Button	Description	Function
	Arrow keys	• Select an option on the current screen or popup menu. • From any graph with the Track option selected, move the crosshairs right or left. • Move the Cell Changer. • Change display contrast (from Home or initialization screens only).

Button	Description	Function
	Numeric keys	Enter a number, minus sign or decimal point.
	Function keys	Access and perform system functions as indicated by associated software labels. Available functions depend on screen in use.
	ESC	• Delete entry. • Remove pop-up box. • Clear error message.
	Enter	Accept changes to field or parameter value.
	Run	Measure sample according to current method.
	Home	Return to Home screen.
	Zero/Base	For Scan methods, performs a baseline scan. For Fixed, Quant and Rate methods, zeros the instrument.

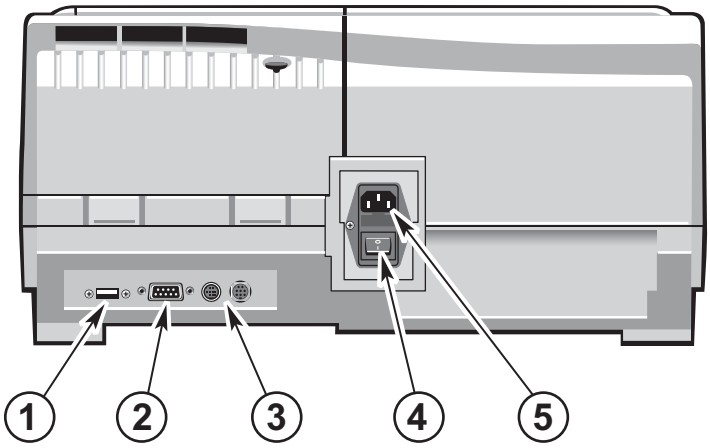
Key functions

Connectors



Front panel features

1	Sample compartment	3	Keypad
2	LCD display	4	USB memory device port



Rear panel features

1	USB printer port	4	Power switch
2	RS-232 PC/LIMS port	5	Power connector
3	Connectors to control optional accessories		

Sample holders

Variable pathlength cell holder (supplied with all instrument models)

Test tube holder (supplied with AquaMate models)

Holder for 1-inch square Hach® Cells and AccuVac® Ampule (supplied with AquaMate models)

Software

The Local Control Software is organized in a tree structure with all functions accessed initially from the Home screen. You can collect and analyze data in five modes:

- **Scan** – Measures absorbance at all points in a defined wavelength range.
- **Fixed** – Measures absorbance or % Transmittance at up to 20 fixed wavelengths.
- **Quant** – Determines sample concentration by comparing measured absorbance values against a concentration curve.
- **Rate** – Measures absorbance at one wavelength over a defined period of time.
- **MCA** – Quantifies up to 20 components in a sample mixture by comparing measured absorbance values against the absorbance of known standards.

The Scan, Fixed, Rate, Quant and MCA options available from the Home screen are independent applications. Only one application can operate at a time.

Notice Loading another application will overwrite any current data. ▲

Note Your instrument may display a Home screen that lists purchased methods or other individual methods that were selected manually for display at start up. To display the default Home screen with the options listed above from the start-up screen, choose General Tests. ▲

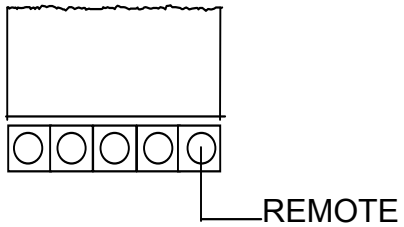
Local and Computer Control

After power up, the instrument is automatically set to local control. Follow these steps to switch between local control and control from an external computer.

Remote computer

To switch from local control to an external computer via the RS-232C port:

1. Display the Home screen.
2. Wait until the instrument is idle.
3. Press *Remote*.



Local computer

To return to local control:

1. Wait until the instrument is idle.
2. Press *Home*.

   The main menu is displayed and the embedded keypad is operational.

Basic operation

To operate the Local Control software:

- Use the function keys directly below the LCD display to move between software screens within an application.
- To initiate an action, use the arrow keys to select an option on the current screen or popup menu and then press *Enter*.
- To return to the Home screen, press *Home*.

Parameter entry

The Local Control software provides the following types of screens and menus for setting and editing parameters:

Pop-up entry box

Use to enter numerical values. The valid range for the parameter is displayed in the menu. This example sets the starting wavelength for scanning:

EDIT VALUE		
START	:	400
MINIMUM	:	190.0
MAXIMUM	:	1100.5

Use the numeric keypad to enter a new value and then press *Enter*. Press *ESC* to close the menu without changing the parameter.

Pop-up menu

Use to select from a list of available options. This example defines the level of smoothing applied to the collected data.

SMOOTHING
NONE
LOW
MEDIUM
HIGH

Use the arrow keys to highlight an option and then press *Enter*.

Toggle

Alternates between two available settings (e.g., yes/no or on/off) when you press *Enter*.

Text entry screen

Use to enter alphanumeric characters such as the Test Name. The software displays the available characters.

To enter a letter or symbol, use the arrow keys to select the character on the display and press *Enter*. Numbers can be entered using the numeric keypad.

The left arrow function key works as a backspace. To remove the entire text string, press *ESC*.

When the entry is complete, press *Accept* to input the new text or *Cancel* to close the screen without changing the parameter.

The following function keys are available from the text entry screen.

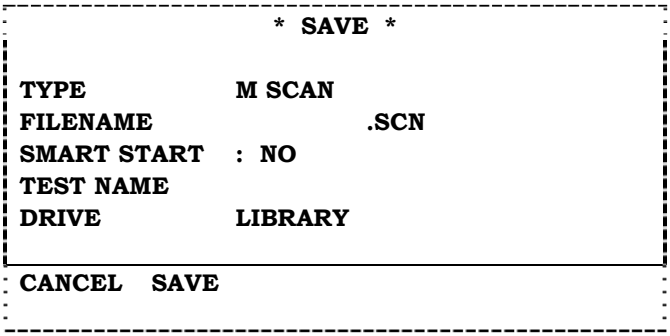
Function key	Description
Cancel	Cancels the operation and returns the previous screen.
Accept	Accepts the text and returns to the previous screen.
←	Clears the last character in the text string.

Saving and renaming methods and data

The Save screen appears in many places in the Local Control software. The options available on the Save screen depend on the type of data being saved (method or data).

Saving a method

To save a method, display the method parameters screen and press *Save Method*. The Save screen is displayed:



Save screen for saving methods

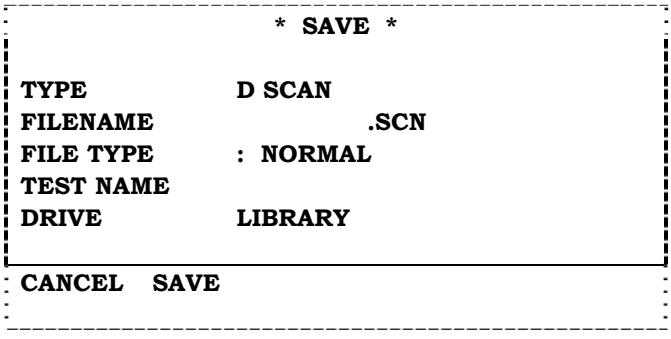
Item	Function
Type	This field is assigned by the software, depending on the type of method being saved.
Filename	This field is selected automatically when you first enter the Save screen. Use the simulated keyboard or the numeric keypad to enter up to 8 characters for the filename and then press *Accept*. See Text Entry screen for details.

Item	Function
Smart Start	Selects whether the file will be displayed on the start-up screen. Press *Enter* to toggle the Smart Start setting between Yes and No. When one or more files are selected for display on the start-up screen, the start-up screen appears when the instrument is turned on (instead of the default Home screen). Press *Home* to see the new start-up screen. From the start-up screen, press *General/ Tests* to display the default Home screen.
Test Name	Use the simulated keyboard or the numeric keypad to enter a descriptive name for the method and then press *Accept*. See Text Entry screen for details.
Drive	Select a destination for the method file. Press *Enter* to toggle the Drive setting between: **Library** – saves the method in the instrument library. **USB Memory** – saves the method on the Library USB memory device installed in the USB Memory Device port on the front of the instrument.

Function key	Description
Save	Stores your entries and displays the method parameters screen.
Cancel	Cancels the Save operation and displays the method parameter screen.

Saving data

To save displayed data, press *Save Data*. The Save screen is displayed:



Save screen for saving data

Item	Function
Type	This field is assigned by the software, depending on the type of data being saved.

Item	Function
Filename	This field is selected automatically when you first enter the Save screen. Use the simulated keyboard or the numeric keypad to enter up to 8 characters for the filename and then press *Accept*. See Text Entry screen for details.
File Type	Selects a file format: **Normal** – the native file type of the Local Control Software. This is the only file type that can be saved in the instrument library. **CSV** – Comma separated variable) **JCAMP-DX** – JCAMP data exchange format.
Test Name	Use the simulated keyboard or the numeric keypad to enter a descriptive name for the data and then press *Accept*. See Text Entry screen or details.
Drive	Select a destination for the data file. Press *Enter* to toggle the Drive setting between: **Library** – saves the file in the instrument library. (Only Normal file types are accepted.) **USB Memory** – saves the file on the Library USB memory device installed in the USB Memory Device port on the front of the instrument. (Saves all file types.)

Function key	Description
Save	Stores your entries and displays the data screen.
Cancel	Cancels the Save operation and displays the data screen.

Scan

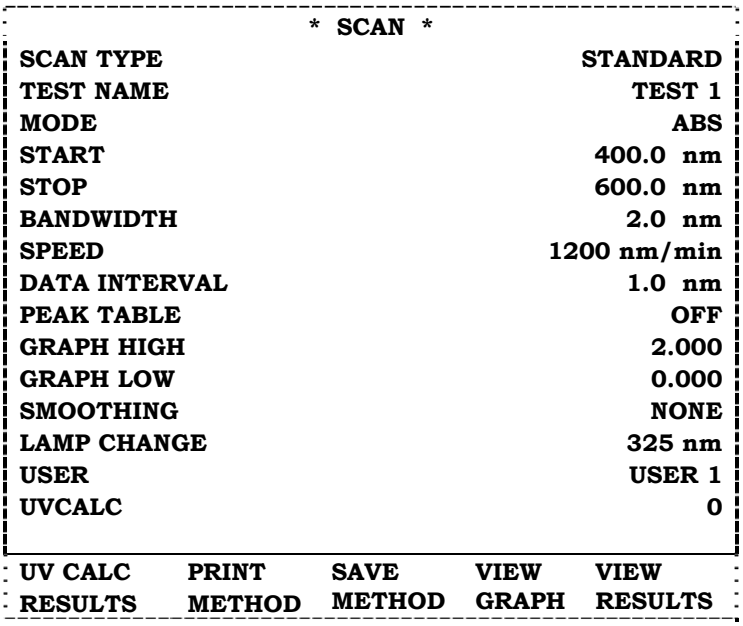
Select the Scan application on the Home screen to collect and analyze data at all points in a defined wavelength range.

Use the Scan Method screen to set data collection and analysis parameters. When you are finished setting parameters, press *Zero/Base* to perform a baseline scan with the current method. When you are ready to analyze the first sample, place the sample cell in the sample holder and press *Run*.

The spectrophotometer performs the scan and displays the result on the Scan Graph screen. From there the spectrum can be manipulated and saved to a Library or USB memory device.

Scan Method screen

Use this screen to set instrument and analysis parameters for collecting and analyzing spectra. To change a parameter setting, highlight the parameter and press *Enter*. See Parameter Entry for more information.



Note The current spectrum will be lost if you change any of the Scan method parameters except the user name (User). ▲

Parameter	Function
Scan Type	Sets scan speed and data interval. **Standard mode** - Allows you to manually set the scan speed and data interval. **Intelliscan™ mode** – Sets the data interval automatically and varies the scan speed according to the absorption of the sample.
Test Name	Use the Text Entry screen to enter a descriptive name for the method. The Test Name is saved with the method and any spectra produced by the method.

Parameter	Function
Mode	Selects the format used to measure and display the collected spectrum. **ABS** - Absorbance vs. Wavelength **%T** - % Transmittance vs. Wavelength **I** - Light Beam Intensity mode vs. Wavelength **1D** - First derivative of the Absorbance vs. Wavelength spectrum **2D** - Second derivative of the Absorbance vs. Wavelength spectrum **3D** - Third derivative of the Absorbance vs. Wavelength spectrum **4D** - Fourth derivative of the Absorbance vs. Wavelength spectrum
Start	Defines the starting wavelength of the scan (must be at least 4 nm less than the Stop wavelength). Enter a wavelength between 190.0 nm and 1096.0 nm (or between 315 nm and 1096 nm for the AquaMate Vis). If the start wavelength requires the deuterium lamp, the lamp will activate automatically.
Stop	Defines the ending wavelength of the scan (must be at least 4 nm greater than the Start wavelength). Enter a wavelength between 190.0 nm and 1100.0 nm (or between 319 nm and 1100 nm for the AquaMate Vis).
Bandwidth	This parameter is fixed at 2.0 nm.
Speed	Sets the scan speed. The available options depend on the setting for Scan Type (above). **If Scan Type = Intelliscan Mode**, select from Color/Zip/Survey/Normal/Quant/Hi-Res. **If Scan Type = Standard Mode**, select from 3800, 2400, 1200, 600, 240, 120, 30, 10 or 1 nm per minute.
Data interval	Sets the frequency of data points in the spectrum. The available options depend on the setting for Scan Type (above). **If Scan Type = Intelliscan Mode**, the data interval is defined by the Intelliscan Mode setting according to the table below.

Intelliscan Mode Setting	Data Interval
Color	10 nm
Zip	4 nm
Survey	2 nm
Normal	1 nm
Quant	0.5 nm
Hi-Res	0.2 nm

Parameter	Function

If Scan Type = Standard Mode, the allowable data interval is defined by the Standard Mode scan speed setting according to the table below. .

Speed	Data interval
3800	10, 4
2400	10, 4, 2
1200	10, 4, 2
600	10, 4, 2, 1, 0.5
240	10, 4, 2, 1, 0.5, 0.2
120	10, 4, 2, 1, 0.5, 0.2
30	10, 4, 2, 1, 0.5, 0.2
10	10, 4, 2, 1, 0.5, 0.2
1	10, 4, 2, 1, 0.5, 0.2

Parameter	Function
Peak Table	Selects the type of peak/point picking done automatically as part of the method. Results are reported on the Peaks screen. Peaks information is stored with any saved spectrum. Available options include: **Off** - Sets Peak Table to Off. No peaks information is produced as part of the scan. **Peaks** - Picks the highest peaks in a spectrum up to a maximum of 10 peaks. **Valleys** - Picks the lowest valleys in a spectrum up to a maximum of 10 valleys. **Pks & Valleys** - Picks the 5 highest peaks and the 5 lowest valleys. **Zero Cross** - Picks all the points where the spectrum crosses zero up to a maximum of 10 crossing points. **Track** - Allows the data values to be reported at up to 10 user selected wavelengths. **Ratio** - Allows you to specify a $\mathrm{ratio}\ (\lambda 1\ /\ \lambda 2)$ to be automatically calculated at the end of the scan. Enter each wavelength at the prompt and press *Enter*. **Corr Ratio** - Allows you to specify the ratio of two wavelengths to be calculated relative to a third wavelength $[(\lambda_1 - \lambda_3)/(\lambda_2 - \lambda_3)]$ at the end of a scan. Enter the wavelengths for the numerator and denominator at the prompts and press *Enter*. **Peak Height** - Allows the height of a peak to be calculated relative to a drawn baseline rather than y = 0. Enter the Baseline 1, Peak, Baseline 2 wavelengths at the prompts and press *Enter*. **Note**: After the wavelengths have been entered, go back to the Scan method screen and save the method.

Parameter	Function
Graph High	Sets the upper graph limits on the Scan Graph screen. Select from range (Graph Low + 0.01) to 6.00. Graph High must be 0.01 greater than Graph Low.
Graph Low	Sets the lower graph limits on the Scan Graph screen. Select from range -0.3 to (Graph High - 0.01). Graph Low must be 0.01 less than Graph High.
Smoothing	Applies No, Low, Medium or High modified/improved Savitzky-Golay smoothing to the spectrum.
Lamp Change	Selects the wavelength at which the source is changed between the tungsten (W) and deuterium (D2) lamp. Select from 315, 320, 325, 330, 335, 340, D2, W. **Note**: Selecting D2 or W manually overrides the Lamp Change setting and the selected lamp will be used regardless of the wavelength set. **Note**: This parameter is not available for the AquaMate Vis.
User	Use the Text Entry screen to enter a user name. The user name is saved with the method and any spectra produced by the method. **Note**: Changing the user name will not cause the current spectrum to be lost. **Note:** If User Log-on is in operation, the user name cannot be changed.
UV*calc*	Displays the UV*calc* screen. See UVcalc for more information.

Function key	Description
View Results	Displays the Scan Peak Table screen after you perform a peak function or the Track Table screen after you use Track.
View Graph	Displays the Scan Graph screen.
Save Method	Displays the Filename Function screen and then saves the method, including User Name, Test Name and track wavelengths if Peak Table is set to Track.
Print Method	Prints the current method parameters using the selected printer.
UVcalc Results	Displays the UVcalc results screen if an equation has been entered and results are available.

Scan Graph function keys

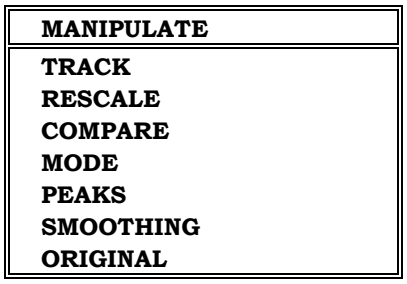
Function key	Description
View Results	Displays the Scan Peak Table screen.
Scan Page	Displays the Scan screen
Save Data	Displays the Save screen for saving methods and data to a USB memory device.
Print Graph	Prints the displayed data using the selected printer.
Manipulate	Displays the Manipulate popup-menu (see descriptions below).

Scan Graph function keys

Press *Run* to start a scan using the current method.

Press *Zero/Base* to start a baseline using the current method.

Manipulate menu options



Menu Option	Function
Track	Reports x- and y-axis values selected with the tracking cursor.
Rescale	Changes x- and y-axis scales automatically or manually.
Compare	Loads a reference spectrum for comparison.
Mode	Defines the format of the collected and displayed data. Select from %T / ABS / 1D / 2D / 3D / 4D.
Peaks	Finds spectral peaks. Select from Peaks/Valleys/Peaks & Valleys/Zero Cross/Ratio/Corr. Ratio/Pk Height.
Smoothing	Applies Low, Medium or High modified/improved Savitsky-Golay smoothing to the spectrum.
Original	Resets the graph to display the data as originally collected.

Track

This option displays the tracking cursor (crosshairs) which can be used to select up to 10 x-axis locations to be measured and reported.

To mark a wavelength, move the cursor to the desired location and press *Enter*. The cursor always moves to a data point regardless of the displayed scales.

Press *View Table* to see a table of measured values for the selected locations.

If you exit the Track graph, the markers will be deleted.

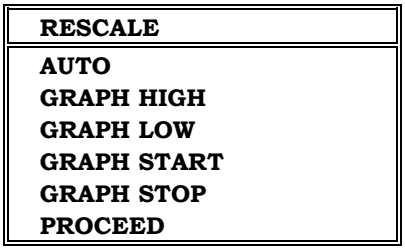
Track graph function keys

Function key	Description
View Table	Displays the Track Table which lists the measured value at each selected wavelength.
Fast/Slow	Toggles between two cursor speeds. In Fast mode, the cursor jumps 5% of the graph or to the next data point, whichever is greater. In Slow mode, the cursor jumps to the next data point or the next display pixel, whichever is greater. The function key label shows the deselected speed; i.e., the opposite of the one you are currently using.
Clear All	Deletes all the markers and the data from the Track Table.
Print Graph	Prints the displayed data (including markers and x- and y-axis values) using the selected printer.
Scan Graph	Displays the Scan Graph screen.

Track screen function keys

Press *ESC* to delete markers in sequence, starting with the marker that has the highest assigned number.

Rescale



Menu Option	Function
Auto	Displays the Scan Graph screen with the x- and y-axes rescaled so that the spectrum fills the screen.
Graph High	Pops up a window to enter the Graph High limit.
Graph Low	Pops up a window to enter the Graph Low limit.
Graph Start	Pops up a window to enter the required start wavelength.
Graph Stop	Pops up a window to enter the required stop wavelength.
Proceed	Used after Graph High, Graph Low, Graph Start or Graph Stop to return to the Scan Graph screen with the graph rescaled using the new parameters.

Compare

This option allows you to display a reference spectrum for comparison. When selected, Compare goes to the Library screen and displays a list of scan data files. Select a reference file and press *Enter*. The reference spectrum appears as a dotted trace.

The reference spectrum remains on the screen (and is printed) with all subsequent scans until you removed it. To remove the reference, select *Manipulate* and then *Original* or load a new method.

Mode

To change the format of the displayed spectrum, choose an option below.

Menu option	Function
ABS	Absorbance.
%T	% Transmittance.
1D	First derivative (records the first derivative of the Absorbance spectrum).
2D	Second derivative (records the second derivative of the Absorbance spectrum).
3D	Third derivative (records the third derivative of the Absorbance spectrum).

Menu option	Function
4D	Fourth derivative (records the fourth derivative of the Absorbance spectrum).

Peaks menu

This option enables the spectrum to be automatically searched for peaks, valleys or zero crossing points. To perform a search, select an option in the menu below and press *Enter*.

FUNCTION
PEAKS
VALLEYS
PKS & VALLEYS
ZERO CROSS
RATIO
CORR RATIO
PK. HEIGHT

When the search is complete, the spectrum is displayed with the peak positions marked. For a peak to be found, there must be more than 15 data points between that point and a previous peak.

The menu options are explained below. For Ratio and Corr Ratio, enter the wavelengths as prompted. All results can be viewed by pressing *View Results*.

Menu Option	Function
Peaks	Marks the 10 highest peaks.
Valleys	Marks the 10 lowest valleys.
Pks & Valleys	Marks the 5 highest peaks and the 5 lowest valleys.
Zero Cross	Marks the first 10 zero crossings.
Ratio	Calculates the ratio λ_1 / λ_2
Corr Ratio	Calculates the ratio $(\lambda_1-\lambda_3) / (\lambda_2-\lambda_3)$
Pk Height	Calculates the peak maximum relative to a local baseline.

Smoothing

This option displays a pop-up menu that can be used to apply a Savitzky-Golay smoothing algorithm to the spectrum. You can smooth with a low, medium or high number of data point. In each case, data points are lost from both ends of the spectrum.

Smoothing	No. of Points Used	Points Lost at Each End
None	0	0
Low	9	4
Medium	17	8
High	33	16

Original

Use this option to remove any manipulation and display the spectrum as originally collected and specified by the scan method. It also clears any reference spectrum that was added with the Compare option. .

Track Table screen

The screen lists the y-axis values of the spectrum for the wavelengths marked using Track. To access this screen, press the *View Table* function key from the Track screen. The format of the measured values (ABS, %T, Intensity, or 1st, 2nd, 3rd, 4th derivative) depends on the current setting for the Mode parameter in the Manipulate menu.

The track markers are saved with the spectrum and will be displayed when the spectrum is reloaded.

Function key	Description
View Graph	Displays the Track Graph which can be used to add or delete markers.
LIMS Export	Sends the results via the RS-232 port.
Print List	Prints the information in the table using the selected printer.
Scan Graph	Displays the Scan Graph screen.

Track table function keys

Peak Table screen

The screen lists the positions and values of the peaks found by the previous peak search. To display this screen, press the *View Results* function key from the Peaks, Valleys, Pks & Valleys, or Zero Cross option in the Peaks menu. The format of the found peaks (ABS, %T, Intensity, or 1st, 2nd, 3rd, 4th derivative) depends on the current setting for the Mode parameter in the Manipulate menu. The list is sorted by wavelength.

Each marker is identified as a peak, valley or zero crossing.

Function key	Description
LIMS Export	Sends the results via the RS-232 port.
Print List	Prints the information in the table using the selected printer.
Scan Graph	Displays the Scan Graph screen.

Peak Table function keys

Ratio Table screen

The screen shows the positions and values of the wavelengths and the ratio as selected by the Ratio or Corr. Ratio functions. To display this screen, press the *View Table* function key from the Ratio or Corr Ratio option in the Peaks menu.

Function key	Description
View Graph	Displays the Scan Graph screen.
LIMS Export	Sends the results via the RS-232 port.
Print List	Prints the information in the table using the selected printer.
Scan Graph	Displays the Scan Graph screen.

Ratio Table function keys

Peak Height screen

This screen shows the locations and measured values of the peaks selected with the Pk Height function. To display this screen, press the View Table function key from the Pk Height option in the Peaks menu.

Function key	Description
View Graph	Displays the Scan Graph screen.
LIMS Export	Sends the results via the RS-232 port.
Print List	Prints the information in the table using the selected printer.
Scan Graph	Displays the Scan Graph screen.

Peak Height function keys

Fixed

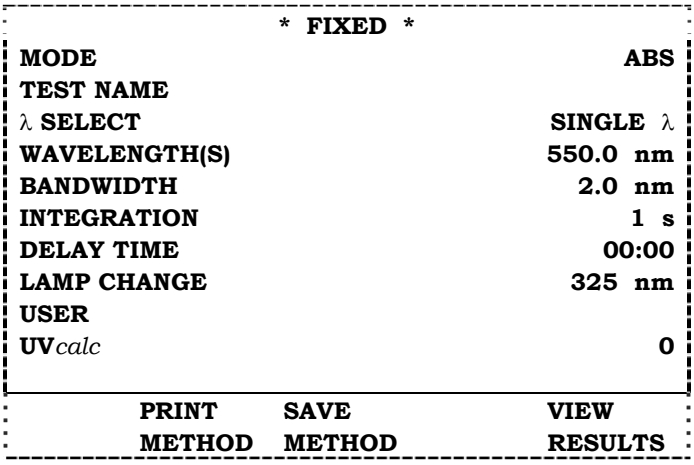
Select the Fixed application on the Home screen to measure absorbance values at up to 20 fixed wavelengths.

Use the Fixed Method screen to set data collection and analysis parameters. When you are finished setting parameters, press *Zero/Base* to perform a baseline scan with the current method. When you are ready to analyze the first sample, place the sample cell in the sample holder and press *Run*.

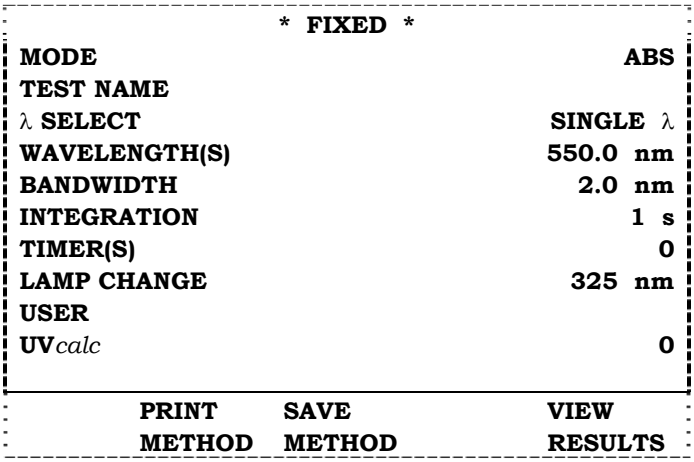
The spectrophotometer performs the measurements and displays the results on the Fixed Results screen. After all the results have been collected, save the data.

Fixed method parameters

Use this screen to set instrument and analysis parameters for measuring and reporting absorbance values at up to 20 fixed wavelengths. To change a parameter setting, highlight the parameter and press *Enter*. See Parameter Entry for more information.



For Zeta, Omega, Evolution 160, UV-10, BioMate 6 models



For AquaMate models

Parameter	Function
Mode	Selects a format for displaying the data. **ABS** – Absorbance **%T** - % Transmittance.
Test Name	Displays the Text Entry screen used to enter a descriptive name for the scan method. The Test Name is saved with the method and any results produced by the method.
λ Select	Selects the number and sequence of wavelengths measured for each sample. **Single λ** - Measures each sample at a single wavelength which is the same for each sample. **Multi λ** - Allows each sample to be measured at up to 20 wavelengths, which are the same for each sample. **Serial λ** - Allows a single wavelength measurement to be made at a different wavelength for each sample for up to 9 samples.
Wavelength(s)	Specifies the wavelength values. **Single λ** - Enter the required wavelength at the prompt and press *Enter*. **Multi λ** - Select the first wavelength and press *Enter* to display a pop-up entry box. Enter the wavelength and press *Enter*. The instrument displays the Multi λ screen with the next wavelength in the list highlighted. Up to 20 wavelengths may be entered. When the list is finished press *Accept* to accept the new list or *Cance*/to return to the Fixed Method screen without changing the wavelength list. **Serial λ** - Press *Enter* to display the entry box for the wavelength to be used for the first sample. Data entry is as for Multi λ above. When the required wavelengths have been entered press *Accept* to accept the new list, or press *Cance*/to return to the Fixed Method screen leaving the original list unchanged.
Bandwidth	This parameter is fixed at 2.0 nm.
Integration	Defines the integration time for which the result is measured. Use the pop-up box to enter a value in seconds. **Note**: The current data will be lost if the integration time is changed.

Parameter	Function
Delay Time (not available for AquaMate models)	Specifies a delay between pressing *Run* and the start of the measurement. Enter a value from 0 to 99 minutes and 59 seconds. Use a decimal point to separate minutes and seconds (e.g., 99:59). The number of seconds must always be entered explicitly.
Timer(s) (for AquaMate models only)	Allows you to add up to 4 timers in a method for specific purposes. For each timer, define the following: **Title** – Select a name that indicates the purpose of the timer (Timer, Wait, Shake, Invert, Swirl, Boil or Heat). **Duration** – Specify a delay time from 1 to 100 seconds in digital format with a period separator (e.g., 00.01 to 99.59). **Action** – Select whether to display a user prompt when the delay time has passed. Choose **Pause** to display a user prompt with three choices (Stop, Zero or Continue). Choose **Continue** to skip the user prompt. After the delay time has passed, the system automatically proceeds to the next task in the measurement sequence. **Note**: Timers can be used with a sipper accessory that is in Auto mode. You cannot use a timer with a cell programmer in Auto mode. See Timer Function Keys for more information.
Lamp Change	Selects the wavelength at which the source is changed between the tungsten and deuterium lamps. Select from 315, 320, 325, 330, 335, 340, D2, W. **Note**: Selecting D2 or W manually overrides the Lamp Change setting and the selected lamp will be used regardless of the wavelength set. **Note**: This parameter is not available for the AquaMate Vis.
User	Displays the Text Entry screen to enter a user name. The user name is automatically saved with the method and any data produced by the method. **Note**: If User Log-on is in operation, the user name cannot be changed.
UV*calc*	Displays the UV*calc* screen.

Function key	Description
View Results	Displays the Fixed Results screen.
Save Method	Displays the Save screen, which allows the method to be saved to a USB memory device.
Print Method	Prints the current method parameters using the selected printer.

Note If the selected wavelength requires the deuterium lamp, the lamp will activate automatically. The current data will be lost if the wavelength is changed. ▲

Pressing *Run* starts a fixed measurement using the current method and then switches to the Fixed Results screen.

Pressing *Zero* starts a zero using the current method.

Note Any changes to the Wavelength, Bandwidth, Integration or Lamp Change parameters will invalidate the current results. ▲

If Autoprint is selected (see Setup for details), a change to the Mode parameter will invalidate the current results.

Timer function keys

Function key	Description
Change Mode	Sets the operating mode for the timers.
	Single Use – Runs all timers before the first measurement only.
	Multiple Use – Runs all timers before each measurement.
Run Timers	Runs the timers without initiating a measurement sequence.
Accept	Stores the timer settings and displays the Fixed Method screen.
Cancel	Cancels the timer settings and displays the Fixed Method screen.

If one or more timers are defined in a method, the first timer starts when you press *Run*. The system shows the remaining time for the current timer. If you need to stop the timer, press *Stop*. If you allow the timer to continue and no user prompt is defined, after the delay time has passed, the system automatically proceeds to the next task in the measurement sequence.

If the timer includes a user prompt, the prompt appears with the following options:

Stop – Interrupts the measurement and displays the Fixed Results screen.

Zero – Takes a baseline measurement.

Proceed – Continues to the next task in the measurement sequence.

After the last timer is completed, the system proceeds to the next measurement task.

Fixed Results screen

The layout of the screen depends on the current settings for the Mode and λ Select parameters on the Fixed Method screen.

Parameter	Function
Single λ	In ABS or %T modes, up to 2 columns of results are displayed per page.
Multi λ	Two columns of results are displayed per page. Results of each sample always start on a new page.
Serial λ	One column of results is displayed per page. Results accumulate on the same page until it is full.

Function key	Description
Clear Results	All results are cleared, ready to start the next batch.
Fixed Page	Displays the Fixed Method screen
Save Data	Displays the Save screen, which allows the results to be saved to a USB memory device.
Print List	Prints the current list using the selected printer.
LIMS Export	Sends the results via the RS-232 port.

Use the up/down arrow keys to display the previous or next page of results.

Results are numbered sequentially, up to 600 samples per batch.

Press *Run* to take another sample measurement.

Press *Zero/Base* to zero the instrument at the wavelength(s) specified in the method.

Quant

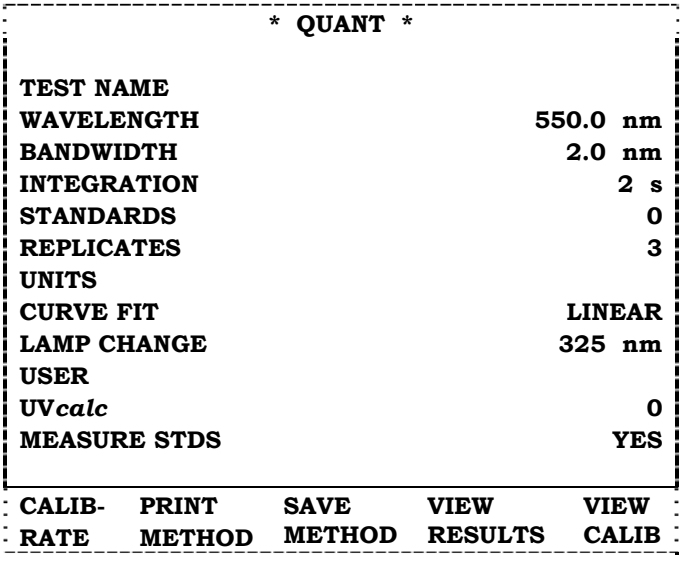
Select the Quant application on the Home screen to measure absorbance values and compare them to a concentration curve in order to determine sample concentration.

Use the Quant Method screen to set data collection and analysis parameters. When you are finished setting parameters, press *Zero/Base* to perform a baseline scan with the current method. When you are ready to analyze the first sample, place the sample cell in the sample holder and press *Run*.

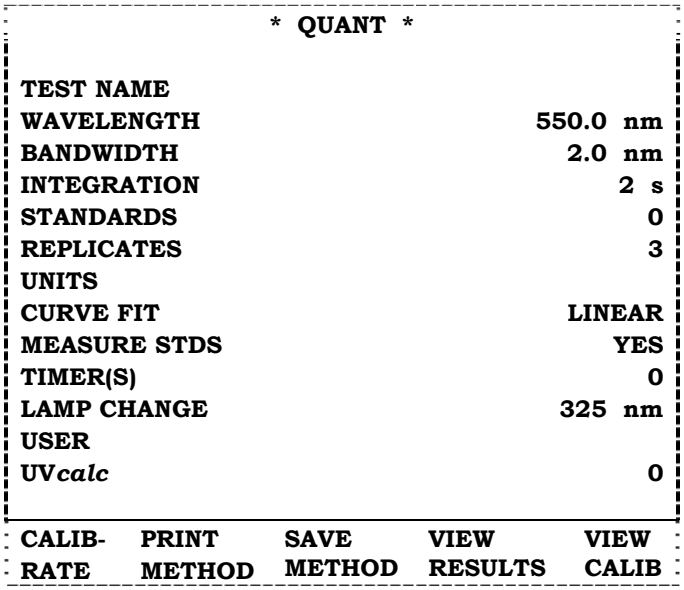
The spectrophotometer performs the measurement and displays the result on the Quant Results screen. After all the results have been collected, save the data.

Quant method parameters

Use this screen to set instrument and analysis parameters for performing quantitative measurements. To change a parameter setting, highlight the parameter and press *Enter*. See Parameter Entry for more information.



For Zeta, Omega, Evolution 160, UV-10, and BioMate 6 models



For AquaMate models

Option	Function
Test Name	Displays the Text Entry screen used to enter a descriptive name for the quant method. The Test Name is saved with the method and any results produced by the method.
Wavelength	Specify a wavelength for measuring the samples. Enter a value between 190.0 nm and 1100.0 nm (or between 325 and 1100nm for the AquaMate Vis). If the selected wavelength requires the deuterium lamp, the lamp will activate automatically. **Note**: The current data will be lost if the wavelength is changed.
Bandwidth	This parameter is fixed at 2.0 nm.
Integration	Defines the integration time for which the result is measured. Enter a value between 1 and 9999 seconds.
Standards	Displays the Standards screen for entering concentrations values for the method standards. See “Standards screen” in the next section for details.
Replicates	Defines the number of times each standard will be measured (1–3). All values are used in the calibration.
Units	Displays the Text Entry screen used to enter the concentration unit for the standards.

Option	Function
Curve Fit	Selects the curve fit algorithm used in the calibration. **Linear** - Performs a linear calibration. At least two standards are required. **Linear to 0** - Performs a linear calibration forced through zero. **Quadratic** - Performs a quadratic fit on the data. At least three standards are required. **Quad to 0** - Performs a quadratic fit with the data forced through zero. At least two standards are required.
Measure Stds	Toggles between internal calibration (Yes) and external calibration (No). Choose **Yes** to measure the standards and calibrate using the concentrations entered on the Standards screen. When ready, press *Calibrate*. At the prompt, insert the first standard in the beam and press *Run*. Repeat for the remaining standards in order. Choose **No** to specify absorbance values for the standards from an external calibration. When ready, press *Calibrate*. Enter the absorbance value of the first standard at the prompt and press *Enter*. Repeat for the remaining standards in order.
Timer(s) (for AquaMate models only)	Allows you to add up to 4 timers in a method for specific purposes. For each timer, define the following: **Title** – Select a name that indicates the purpose of the timer (Timer, Wait, Shake, Invert, Swirl, Boil or Heat). **Duration** – Specify a delay time from 1 to 100 seconds in digital format with a period separator (e.g., 00.01 to 99.59). **Action** – Select whether to display a user prompt when the delay time has passed. Choose **Pause** to display a user prompt with three choices (Stop, Zero or Continue). Choose **Continue** to skip the user prompt. After the delay time has passed, the system automatically proceeds to the next task in the measurement sequence. **Note**: Timers can be used with a sipper accessory that is in Auto mode. You cannot use a timer with a cell programmer in Auto mode. See Timer Function Keys for more information.

Option	Function
Lamp Change	Selects the wavelength at which the source is changed between the tungsten and deuterium lamps. Select from 315, 320, 325, 330, 335, 340, D2, W. **Note**: Selecting D2 or W manually overrides the Lamp Change setting and the selected lamp will be used regardless of the wavelength set. **Note**: This parameter is not available for the AquaMate Vis.
User	Displays the Text Entry screen used to enter a user name. The user name is automatically saved with the method and any data produced by the method. **Note**: Changing the user name will not cause any current data to be lost. **Note**: If User Log-on is in operation, the user name cannot be changed.
UV*calc*	Displays the UV*calc* screen. See UVcalc for more information.

Function key	Description
View Calib	Displays the Quant Graph screen if valid calibration exists.
View Results	Displays the Quant Results screen if sample results exist for this method.
Save Method	Displays the Save screen, which allows the method to be saved to a USB memory device.
Print Method	Prints the current method parameters and the standards table using the selected printer.
Calibrate	Displays the Standards screen.

Note The current data will be lost if the integration time is changed. ▲

Note Changing the standards will cause any current data to be lost. ▲

Note Changing the curve fit will cause the existing calibration to be recalculated. Any results associated with the previous calibration will be lost. ▲

Note Any current data will be lost if the lamp changeover wavelength is changed. ▲

Timer function keys

Function key	Description
Change Mode	Sets the operating mode for the timers.
	Single Use – Runs all timers before the first measurement only.
	Multiple Use – Runs all timers before each measurement.
Run Timers	Runs the timers without initiating a measurement sequence (for example, when collecting standards for a method that uses timers).
Accept	Stores the timer settings and displays the Fixed Method screen.
Cancel	Cancels the timer settings and displays the Fixed Method screen.

If one or more timers are defined in a method, the first timer starts when you press *Run*. The system shows the remaining time for the current timer. If you need to stop the timer, press *Stop*. If you allow the timer to continue and no user prompt is defined, after the delay time has passed, the system automatically proceeds to the next task in the measurement sequence.

If the timer includes a user prompt, the prompt is displayed with the following options:

Stop – Interrupts the measurement and displays the Fixed Results screen.

Zero – Takes a baseline measurement.

Proceed – Continues to the next task in the measurement sequence.

After the last timer is completed, the system proceeds to the next measurement task.

Quant Standards screen

This screen lists the standards for the Quant method. Before the system can be calibrated, each standard must have a concentration entered.

To enter the concentration values of the standards, select a standard and press *Enter* to display the concentration entry box. Enter the concentration of the standard and press *Enter*. The Standards screen is displayed with the new value displayed and the next standard highlighted. Up to 20 standards can be specified.

When all the standards have been entered, press *Accept* to return to the Quant Method screen with the new list of standards, or *Cancel* to return leaving the old list unchanged.

If a calibration has been done, the correlation coefficient and the equation are displayed.

If a calibration has not been done, pressing *Run* causes the warning prompt "CANNOT RUN WITHOUT CALIBRATION" to appear. Otherwise it takes a sample measurement and switches to the Quant Results screen. Pressing *Zero/Base* starts a zero using the current method.

Function key	Description
View Calib	Displays the Quant Graph screen if valid calibration exists.
View Results	Displays the Quant Results screen if sample results exist for this method.
Quant Page	Displays the Quant screen.
Edit Std (appears after calibration)	Allows you to specify whether each standard will be used, ignored or re-measured.
Edit Curve (appears after calibration)	Allows you to change the curve fit.

Quant Standards function keys

Quant Calibration screen

Press *Zero/Base* to zero the instrument with the current method.

To start the calibration, display the Quant Method screen and press *Calibrate*. The Quant Calibration graph is displayed and the instrument prompts for each standard (and replicate) in turn. As the measurements of the standards proceed, the data points are marked on the graph. When all the standards have been measured, the system calculates the equation, rescales the graph and then draws and displays the line of best fit on the graph.

To stop the calibration, press *Stop*. The calibration is aborted and the software returns to the Quant Standards screen. Any values obtained are lost.

Press *Run* to start the first sample measurement. The sample results appear automatically on the Quant Results screen.

Note If you press *Run* before the calibration step is completed, the message "CANNOT RUN WITHOUT CALIBRATION" is displayed. Press *ESC* to clear the error message. ▲

Function key	Description
View Results	Displays the Quant Results screen if sample results exist for this method.
Quant Page	Displays the Quant screen.
Standards	Displays the Standards screen.
Print Graph	Prints the Quant method and calibration graph.
Save Method	

Calibrate function keys

Quant Results screen

Results are numbered sequentially, up to 600 samples per batch. Use the up/down arrow keys to display the previous or next page of results.

Press *Run* to take another sample measurement. The results are displayed automatically.

Function key	Description
Clear Results	Deletes all data from the Quant Results table.
Quant Page	Displays the Quant screen.
Save Data	Displays the Save screen.
Print List	Prints the Quant Results using the selected printer.
LIMS Export	Sends the results via the RS-232 port.

Quant Results function keys

Rate

Select the Rate application on the Home screen to measure absorbance at one wavelength over a period of time.

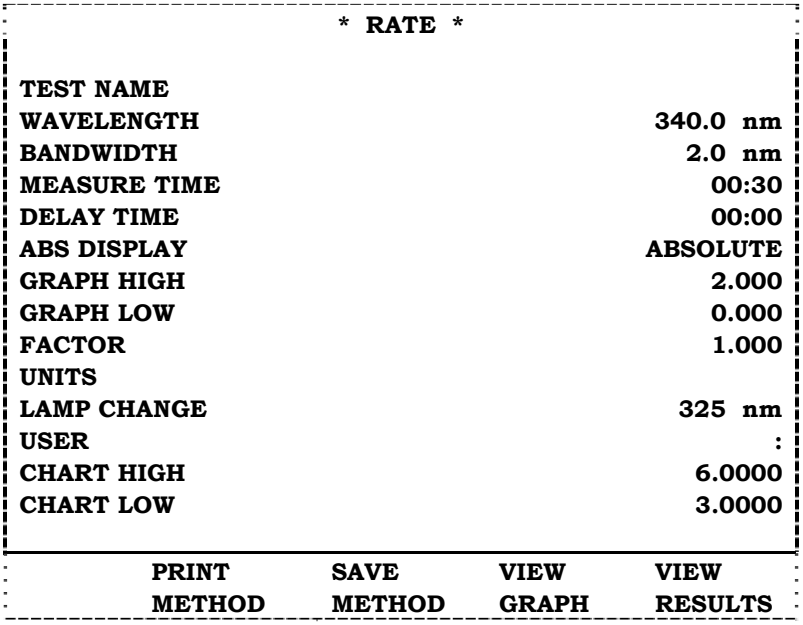
Use the Rate Method screen to set data collection and analysis parameters. When you are ready to analyze the first sample, press Zero to zero the instrument. Then place the sample cell in the sample holder and press *Run*.

The spectrophotometer performs the measurements and displays the result on the Rate Graph screen. From there the spectrum can be manipulated and saved to a Library or USB memory device.

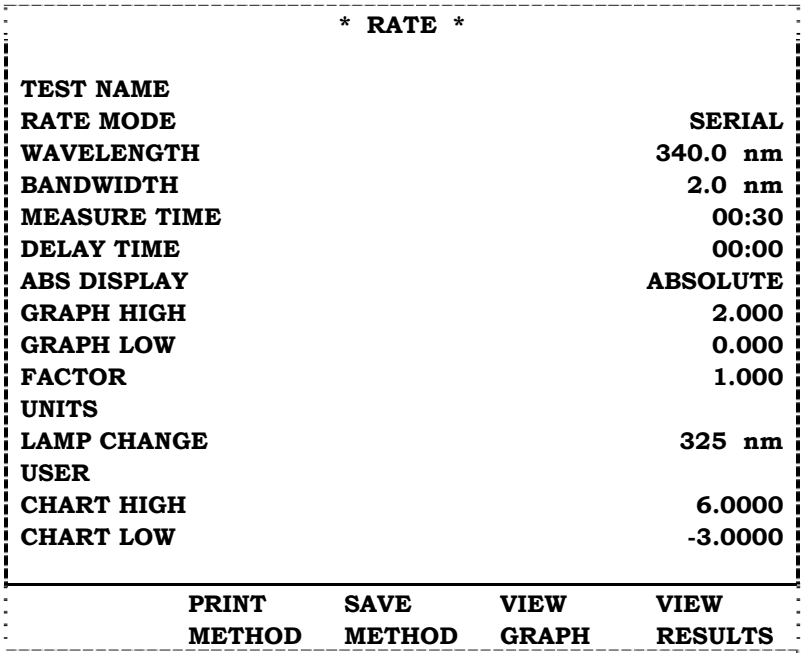
Rate Method screen

Use this screen to set instrument and analysis parameters for measuring and reporting absorbance values collected over a period of time. To change a parameter setting, select the parameter and press *Enter*. See Parameter Entry for more information.

Note The current data will be lost if any of the method parameters (except for the Test Name, Slope, Factor, Units and User name) are changed. ▲



For Zeta, Omega, Evolution 160, UV-10, AquaMate Plus, AquaMate Vis models



For BioMate 6 model

Menu Item	Function
Test Name	Use the Text Entry screen to enter a descriptive name for the method. The Test Name is saved with the method and any spectra produced by the method.
Rate Mode	When the 7-Cell Changer is installed, Rate Mode toggles between the Serial and Parallel settings: **Parallel** - Rate measurements for up to 7 samples may be made in parallel. In this mode, MEASURE INTERVAL sets the time between each cycle, i.e. the length of time between successive measurements on the first sample. The number of measurements taken on each sample is set by the MEASURE CYCLES parameter. The total time over which the measurements are made is the product of the MEASURE INTERVAL and the MEASURE CYCLES. For example, an analysis using 4 cells with MEASURE INTERVAL set to 15 seconds and MEASURE CYCLES set to 20 seconds would give a total measurement time of 5 minutes. **Serial** - Each sample is measured individually. In this mode, MEASURE TIME replaces MEASURE INTERVAL and sets the total time over which the sample is measured. (Use this setting when you want the 7-cell changer to behave like a single cell holder.) When the single cell holder is installed, Rate Mode is automatically set to Serial. .
Wavelength	Selects a wavelength for measuring the samples. Enter a value between 190 nm and 1100 nm (or between 325 and 1100nm for the AquaMate Vis). If the selected wavelength requires the deuterium lamp, the lamp will activate automatically. **Note**: Any current data will be lost if the wavelength is changed.
Bandwidth	This parameter is fixed at 2.0 nm.

Menu Item	Function
Measure Time	Defines the time period over which the sample will be measured. Enter a value in the range between 00:05 seconds and 99:59 seconds in steps of 1 second. If the Cell Changer is On, the measurement time sets the time between individual measurements on the first cell (i.e., the time for each cycle).
Delay Time	Sets the time between pressing *Run* and the start of the measurement. Enter a value in the range between 00:05 and 99:59 seconds in steps of 1 second.
Abs Display	Toggles the graphical display between the Absolute Values and Relative Values settings. **Absolute Values** – Plots the measured absorbance values in Absorbance vs. Time. When Abs Display = Absolute, the Graph High and Graph Low parameters appear on the Rate Method screen. **Relative Values** – Plots the measured absorbance values relative to the first measurement (subtracts the first measured absorbance value from all subsequent measurements). This causes the plot to start at the 0,0 coordinate (change in Absorbance vs. Time). When Abs Display = Relative, the Slope and Range parameters appear on the Rate Method screen.
Graph High	Sets the maximum y-axis value on the displayed graph. Enter a value from 0.010 to 3.000. **Note**: This parameter appears only when ABS DISPLAY is set to ABSOLUTE.
Graph Low	Sets the minimum y-axis value on the displayed graph. Enter a value in the range between 0.010 and 2.990. **Note**: This parameter appears only when ABS DISPLAY is set to ABSOLUTE.
Slope	Sets the graph to display positive or negative changes in Absorbance. **Positive** – Select this option if Absorbance increases with time. **Positive** – Select this option f Absorbance decreases with time. **Note**: This parameter appears only when ABS DISPLAY is set to RELATIVE.
Range	This sets the graph y-axis. Enter a number in the range between 0 and 3 A. Enter a number slightly larger than the expected change in Absorbance. **Note**: This parameter appears only when ABS DISPLAY is set to RELATIVE.
Factor	Enter the factor for Activity as a number in the range between 0.001 and 9999.999.
Units	Displays the Text Entry screen used to enter the units of Activity. Enters the required description or units of Activity up to 11 alphanumeric characters.
Lamp Change	Selects the wavelength at which the source is changed between the tungsten and deuterium lamps. Select from 315, 320, 325, 330, 335, 340, D2, W. **Note**: Selecting D2 or W manually overrides the Lamp Change setting and the selected lamp will be used regardless of the wavelength set. **Note**: This parameter is not available for the AquaMate Vis.

Menu Item	Function
User	Displays the Text Entry screen to enter a user name. The user name is automatically saved with the method and any data produced by the method. Changing the user name will not cause the current data to be lost. **Note**: If User Log-on is in operation, the user name cannot be changed.
Chart High	Sets the maximum y-axis value on the analog output. Select from -2.9999 to 6.0000.
Chart Low	Sets the minimum y-axis value on the analog output. Enter a number in the range between -3.0000 and 5.9999.
Number of Samples	Available only when the Cell Changer is installed and ABS Display is set to Parallel. See Parallel Rate Measurements using the Cell Changer for more information.
Measure Cycles	Available only when the Cell Changer is installed and ABS Display is set to Parallel. See Parallel Rate Measurements using the Cell Changer for more information.

Function key	Description
View Results	Displays the Rate Results screen.
View Graph	Displays the Rate Graph screen.
Save Method	Displays the Save screen, which allows the method to be saved to a USB memory device.
Print Method	Prints the current method parameters using the selected printer.

Rate Graph screen

This screen displays the Rate curve and allows it to be manipulated.

Function key	Description
View Results	Displays the Rate Results screen.
Rate Page	Displays the Rate Method screen.
Save Data	Displays the Save screen, which allows the method and data to be saved to a USB memory device.
Print	Prints the rate graph and the results using the selected printer. (If a Cell Programmer is fitted, see the note below.)
Manipulate	Displays the Manipulate pop-up menu (see descriptions below).

Rate Graph function keys

If you are using the Cell Changer to run more than one rate in parallel, three more print options are available:

All Overlay	Prints the results of all cells in the run on one sheet of paper up to a maximum of 4 results. If more than four results are present, the rest are printed on a second sheet.
All Sequential	Prints each result in the run on a separate sheet of paper.
One Result	Prints only the displayed results.

Press *Run* to start a measurement using the current method.

Press *Zero/Base* to zero the instrument using the wavelength specified in the current method.

Manipulate menu options

MANIPULATE
TRACK
RESCALE
SECTION
SMOOTHING
ABS DISPLAY
ORIGINAL
ANOTHER CELL

Item	Function
Track	Sets the start and stop time for the rate calculation.
Rescale	Changes x- and y-axis scales automatically or manually.
Section	Sets sequential start and stop times to enable rates to be calculated on up to four sections of the rate curve.
Smoothing	Allows three levels of smoothing to be applied to the Rate Curve.
ABS Display	Toggles the graphical display between Absolute Values (plots the measured absorbance of each sample vs. time) and Relative Values (plots the change in absorbance relative to the first measurement over time.)
Original	Resets the graph to display the data as originally collected.
Another Cell	Only present if the Cell Changer has been used. Enables the results of another cell from the same run to be displayed.

Track

Use the arrow keys to move the cursor (vertical line) across the screen. The cursor always moves to a data point regardless of the displayed scales. Pressing *Enter* places a marker at the current time.

To delete a marker, place the cursor on the marker and press *Clear*.

The x-axis values are used to recalculate the rate of change of Absorbance between the new start and stop times. Results are listed on the Rate Results screen.

Up to four discrete pairs of cursors can be placed on the graph. Arrows are placed on the cursors and results are displayed on the Rate Results screen for those parts of the graph indicated by the arrows. The minimum interval between Track cursors is one second.

Selecting *Section* will remove the Track markers.

Track graph function keys

Function key	Description
View Results	Displays the Rate Results screen.
Fast/Slow	Toggles between two cursor speeds. In Fast mode, the cursor jumps 5% of the graph or to the next data point, whichever is greater. In Slow mode, the cursor jumps to the next data point or the next display pixel, whichever is greater. The function key label shows the deselected speed, i.e., the opposite of the one you are currently using.
Clear All	Deletes all the markers from the Track Graph.
Print	Prints the displayed data using the selected printer.
Rate Graph	Displays the Rate Graph screen.

Track screen function keys

Section

Use the arrow keys to move the cursor (vertical line) across the screen. The cursor always moves to a data point regardless of the displayed scales. Pressing *Enter* places a marker at the current time.

To delete a marker, place the cursor on the marker and press *Clear*.

Up to five markers can be placed on the graph. Rate results will be reported between markers providing a maximum of four sets of results (Sections). The minimum Section size is one second.

Results are listed on the Rate Results screen.

Selecting *Track* will remove the Section markers.

Rescale

This option displays a pop-up menu for changing the graph y-axis scale. The options available in the menu depend on the current setting for the ABS Display option in the Manipulate menu described above.

Absolute Absorbance

If ABS Display (Manipulate menu) is set to Absolute Values, the Rescale menu has the following options:

RESCALE
AUTO GRAPH HIGH GRAPH LOW

Option	Function
Auto	Displays the Rate Graph with the y-axis rescaled so that the trace fills the screen.
Graph High, Graph Low	Sets the upper and lower y-axis limits for the Rate Graph.

Relative Absorbance

If ABS Display (Manipulate menu) is set to Relative Values, the Rescale menu has the following options:

RESCALE
AUTO RANGE

Option	Function
Auto	Displays the Rate Graph with the y-axis rescaled so that the trace fills the screen.
Range	Allows the user to set the upper y-axis limit.

ABS Display

This option toggles the graphical display between the Absolute Values and Relative Values settings.

Absolute Values – Plots the measured absorbance values in Absorbance vs. Time.

Relative Values – Plots the measured absorbance values relative to the first measurement (subtracts the first measured absorbance value from all subsequent measurements). This causes the plot to start at the 0,0 coordinate (change in Absorbance vs. Time).

Smoothing

This option displays a pop-up menu that can be used to apply a Savitzky-Golay smoothing algorithm to the data. You can smooth with a low, medium or high number of data point. A moving point average is performed on the data and, in each case, data points are lost from both ends of the data.

Smoothing	No. of Points Used	Points Lost at Each End
None	0	0
Low	9	4
Medium	17	8
High	37	18

Original

Use this option to remove any manipulation and display the rate graph as originally specified by the rate method.

Another Cell

If you used the Cell Changer to run more than one rate in parallel, use this function to select and display the results from any cell in the run. Enter the number of the cell you wish to display.

Rate Results screen

This screen displays the Initial and Final Absorbance, Initial and Final Time, the change in absorbance per minute, calculated Activity, Correlation Coefficient of the best fit line and the smoothing parameter used.

If the rate curve has been tracked, the Initial and Final Absorbance with the Initial and Final Time will reflect those chosen by the two cursors.

Function key	Description
View Graph	Displays the Rate Graph.
Rate Page	Displays the Rate Method screen
Save Data	Displays the Save screen for saving methods and data to a USB memory device.
Print	Prints the Rate Graph and Rate Results using the selected printer.
LIMS Export	Sends the results via the RS-232 port.

Rate Results function keys

Parallel Rate measurements using the Cell Changer

The 7-Cell Changer can be used in conjunction with the Rate software to measure between 2 and 7 cells in parallel.

For the Cell Changer to be used it must be On with Mode set to Auto.

The Rate Method setup and Manipulate functions are exactly the same except that the Measure Time now sets the time between each cycle; i.e., the length of time between measurements on the first cell. The number of measurements taken on each cell is set by the Cell Cycles parameter on the Cell Changer screen. The total time over which the measurements are made is the result of the time between measurements (Measure Time) and the number of measurements (Cell Cycles). For example, an analysis using four cells with Measure Time set to 15 seconds and Cell Cycles set to 20 would give a total measurement time of 5 minutes.

To set up a parallel rate method, following these steps:

1. **Set up the method as normal on the Rate Method screen.**

Note Measure Time specifies the time between each measurement on the first cell. ▲

2. **Display the Cell Changer screen.**

   Press *Home* then *Accessories* and select *Cell Prog*.

3. **Set up the Cell Changer method as required.**

4. **Return to the Rate Method screen and press *Zero/Base* to zero the instrument (if required).**

5. **Press *Run* to start the analysis**

   The rate graph shows the data for the first cell.

To view the result of any other cell, press *Manipulate* on the Rate Graph screen and select *Another Cell*. The cell number currently displayed is shown to the right of the ID: line.

To print the results, press *Print* from the Rate Graph screen or the Rate Results screen. The following options appear:

All Overlay – Prints the results of all cells in the run together in batches of 4. Track and Section markers are not included.

All Sequential – Prints each result in the run separately. Track and Section markers are included.

One Result – Prints the result currently displayed. Track and Section markers are included.

Multicomponent Analysis (MCA)

Select the MCA application on the Home screen to measure up to 20 components in a sample mixture. You can set up the method to measure up to 20 wavelengths per sample.

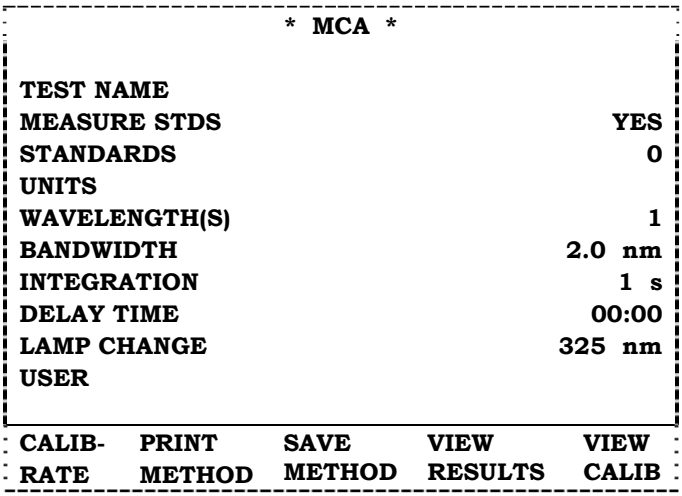
Standards can be measured at run time or loaded from files obtained using the Multi λ function available from the Fixed application.

Use the MCA Method screen to set data collection and analysis parameters. When you are finished setting parameters, press *Zero/Base* to perform a baseline scan with the current method. When you are ready to start the analysis, place the sample cell in the sample holder and press *Run*.

The spectrophotometer performs the measurement and displays the result on the MCA Results screen. After all the results have been collected, save the data.

MCA Method screen

Use this screen to set instrument and analysis parameters for performing a multi-component analysis. To change a parameter setting, highlight the parameter and press *Enter*. See Parameter Entry for more information.



Item	Function
Test Name	Displays the Text Entry screen used to enter a descriptive name for the quant method. The Test Name is saved with the method and any results produced by the method.
Measure Stds	Toggles between internal calibration (Yes) and external calibration (No). Choose **Yes** to measure the standards with the run. All fields remain editable. Choose **No** to load standards from a Library or USB memory device. The Wavelength(s), Bandwidth, Integration, Delay time, Lamp change and User Name are also loaded with the standards and cannot be edited. Any attempt to do so causes the prompt "Change method by loading MCA standards" to appear and no action is taken.
Standards	Displays the Standards screen for entering concentrations values for up to 20 method standards. See MCA Standards screen for details.
Units	Displays the Text Entry screen used to enter the concentration unit for the standards.
Wavelength(s)	Specify up to 20 wavelengths for measuring the samples. Each wavelength can be between 190 nm and 1100 nm (or 325 and 1100nm for the AquaMate Vis). If the selected wavelength requires the deuterium lamp, the lamp will activate automatically. **Note**: The current data will be lost if the wavelength is changed.
Bandwidth	This parameter is fixed at 2.0 nm.
Integration	Defines the integration time for which the result is measured. Enter a value between 1 and 9999 seconds.
Delay Time	Specifies a delay between pressing *Run* and the start of the measurement. Enter a value from 0 to 99 minutes and 59 seconds. Use a decimal point to separate minutes and seconds (e.g., 99.59). The number of seconds must always be entered explicitly. **Note**: This field is only available if *UVcalc* is installed.

Item	Function
Lamp Change	Selects the wavelength at which the source is changed between the tungsten and deuterium lamps. Select from 315, 320, 325, 330, 335, 340, D2, W. **Note**: Selecting D2 or W manually overrides the Lamp Change setting and the selected lamp will be used regardless of the wavelength set. **Note**: This parameter is not available for the AquaMate Vis.
User	Displays the Text Entry screen to enter a user name. The user name is automatically saved with the method and any data produced by the method. Changing the user name will not cause any current data to be lost. **Note**: If User Log-on is in operation, the user name cannot be changed.

Function key	Description
View Results	Displays the Results table if it contains results.
View Stds	Displays the Standards results table if a calibration has been performed.
Save Method	Displays the Save screen, which allows the method to be saved to a USB memory device.
Print Method	Prints the current method parameters using the selected printer.
Calibrate	Displays the Calibration screen to perform a calibration if standards and wavelengths have been entered.

Note Changing the Measure Stds parameter will cause all previous data to be lost. ▲

Note The current data will be lost if the integration time is changed. ▲

Note The current data will be lost if the lamp change parameters are changed. ▲

MCA Standards screen

When Measure Stds is set to **Yes**, this screen lists the standards for the MCA method. Before the system can be calibrated, each standard must have a name and associated concentration entered.

To define the standards, select a standard and press *Enter*. The Text Entry screen is displayed. Enter the name of the standard and press *Accept*. The instrument returns to the Standards screen and the concentration field is highlighted for the current standard. Press *Enter* to display the pop-up entry box. Use the numeric keys to enter the concentration of the standard and press *Enter*. The Standards screen is displayed with the next standard highlighted. Up to 20 standards can be specified with up to 10 standards per page. (Press *Std11-Std20* to display page 2 or *Std1-Std10* to display page 1).

When Measure Stds is set to **No**, press *Enter* to display the Library screen. Use the Library functions to select and load the file for each standard in sequence.

Note Use the Multi λ function available from the Fixed application to build a library of standards for your multi-component analysis. If you do that, make sure you use the same method every time you run your standards and those conditions will be used in your MCA automatically. ▲

The same method must be used for each Multi λ result, and will be used for the MCA analysis. When the first Multi λ file is loaded, the current MCA method is changed to that used to obtain the Multi λ result. Standards can thus be used in any combination without having to recalibrate for each new mixture.

Function key	Description
Std1-Std10 Std11-Std20	Toggles between page 1 and page 2 of the Standards screen.
Accept	Accepts any changes made to the Standards list and displays the MCA Methods screen.
Cancel	Deletes any changes made to the Standards list and displays the MCA Methods screen.

MCA Standards function keys

MCA Wavelength screen

This screen lists the wavelengths to be measured. You can measure up to 20 wavelengths. You must enter at least one wavelength for each standard.

To enter the wavelengths, select a wavelength and press *Enter.* The wavelength entry box is displayed. Enter the wavelength and press *Enter*. You do not need to enter them in numerical order; however, the analysis will be faster if you do. The Wavelength screen is displayed with the new value displayed and the next wavelength highlighted. When all wavelengths have been entered, press *Accept* to return to the MCA method screen with the new list of wavelengths or *Cancel* to return leaving the old list unchanged.

Alternatively wavelengths may be entered directly from a scan. Clear the beam(s) and press *Zero Base* to perform a baseline scan, then put the sample in the cell holder and press *Scan Graph*. The instrument performs a scan using the method currently entered in the Scan Parameters screen.

Move the vertical cursor to a suitable wavelength and press *Enter* to mark it. Repeat until all required wavelengths have been marked. Marks can be removed using *Clear*, or *Clear All*. When all required wavelengths have been marked, press *Accept* to accept the list and return to the MCA Methods screen.

Wavelengths can be selected either from a scan of the mixture to be analyzed or by performing a scan on each standard in turn and selecting suitable wavelengths. Wavelengths already entered in the table are shown on the Scan Graph.

Function key	Description
Accept	Accepts any changes made to the Wavelength list and displays the MCA Methods screen.
Fast/Slow	Toggles between two cursor speeds. In Fast mode, the cursor jumps 5% of the graph or to the next data point, whichever is greater. In Slow mode, the cursor jumps to the next data point or the next display pixel, whichever is greater.
Clear All	Clears all marks.
Rescale	Rescales the x- and y-axes so that the spectrum fills the screen.

MCA Wavelengths function keys

MCA Calibration screen

Before you calibrate, use the MCA Standards screen to define the standards and the MCA Wavelengths screen to specify the wavelengths to be measured.

When you are ready, clear the beam(s) and press *Zero Base* to perform a baseline scan.

To start the calibration, display the MCA Method screen and press *Calibrate*.

Notice If the results from a previous calibration are displayed, you will be given the option to proceed or cancel. If you select *Proceed*, the previous data will be lost. ▲

Press *Enter* to start the calibration. The message "Press Run to measure STD1:" is displayed. Place the first standard in the beam and press *Run*. Continue until all standards have been measured. The results for each standard are stored in the Calibration Results Table; the data for each standard is displayed on a new page. Use the arrow keys to display the next or previous page.

When you have finished measuring the standards, place the first sample in the beam and press *Run* (see the next section for more information).

Analyzing a sample

When a calibration has been performed, or loaded with the method, the MCA application is ready to use.

To measure a sample, place the sample in the beam and press *Run* from the MCA Method or Results screen. The instrument measures the absorbance of the sample at each of the wavelengths specified in the method and compares it with the absorbance values of the standards at these wavelengths. The concentration of each component is calculated and displayed on the Results screen. The results for each sample are displayed on a new page. Use the arrow keys to display the next or previous page.

Function key	Description
Clear Results	Clears the Results Table.
MCA Page	Displays the MCA Method screen.
Save Data	Displays the Save screen for saving data to the Library or a USB memory device.
Print List	Prints the data using the selected printer.

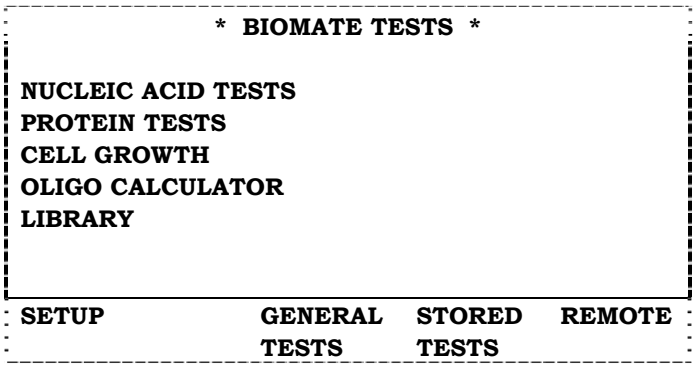
Bio Tests

This section applies to the BioMate 6 spectrophotometers only.

The BioMate 6 provides an assortment of general tests used to characterize biological and biochemical substances. These tests fall into the following categories:

- Nucleic acid measurements
- Protein measurements
- Cell growth analysis

These tests are accessed from the BioMate Tests screen, which appears when you start the instrument or press *Home*.



Note To display the default Home screen for Local Control Software, from the BioMate Tests start-up screen choose General Tests. ▲

BioMate applications

All of the parameters for the BioMate applications described in this section are factory set. This means if you want to change the parameters, you will need to save them with a different name.

Note See BioMate 6 Test Parameters for a list of all the parameters used in each pre-set test. See Calculations for BioMate 6 Tests for a list of calculations used by each test. ▲

Nucleic acid measurements

These tests can be used to determine the concentration and purity of nucleic acid in an unknown sample.

DNA – Measures absorbance at 260 nm and 280 nm or at 260 nm and 230 nm and determines concentration and purity based on the absorbance ratio and absorbance difference.

DNA with scan – Records absorbance scan between 260 nm and 280 nm or between 260 nm and 230 nm and determines concentration and purity based on the absorbance ratio and absorbance difference.

DNA/RNA Conc – Measures absorbance at 260 nm and calculates concentration based on the absorbance and concentration factor.

RNA – Measures absorbance at 260 nm and calculates concentration based on the absorbance and concentration factor.

Oligonucleotides – Measures absorbance at 260 nm and calculates concentration based on either the absorbance and concentration factor or the absorbance and concentration factor determined by the oligo calculator application.

Several of these categories include multiple tests that are similar. For example, the parameters are the same for the Direct UV measurement of ssDNA and RNA tests, but the factor used to convert absorbance to concentration is different. Similarly, the parameters for the Direct UV measurement of oligonucleotide tests are also the same but the factors used to convert absorbance to concentration are different. Screen images are provided as examples but are not comprehensive. For a complete list of all parameters and calculations for each test, refer to the appendices.

To change a parameter setting, highlight the parameter and press *Enter*. See Parameter Entry for more information.

DNA tests

This group includes two tests that function almost identically—the only difference is in the wavelengths used for the measurements (one measures absorbance at 260 nm and 280 nm; the other at 260 and 230 nm.)

The example below shows the parameters for the DNA (260/280) test. For the DNA (260/230) test, Wavelength 2 is set to 230 nm.

```
                * DNA (260/280) *

TEST NAME                              DNA (260/280)
WAVELENGTH 1                                260.0 nm
WAVELENGTH 2                                280.0 nm
REF. WAVELENGTH CORRECTION                      OFF
DNA FACTOR (λ1)                               50.00
DNA FACTOR (λ2)                               0.000
DISPLAY PROTEIN                                  NO
DILUTION MULTIPLIER                            1.00
UNITS                                          µg/ml
ID#  (0=OFF)                                      0
AUTOPRINT                                       OFF
USER

PRINT          SAVE       STORED     VIEW
TEST           TEST       TESTS      RESULTS
```

DNA (260/280) test parameters

Measuring DNA

1. **Display the appropriate DNA parameter screen and enter the initial sample number (ID#).**
2. **Place the blank in the cell holder.**
3. **Press *Zero/Base* to measure the blank.**
4. **Place the unknown sample in the cell holder.**
5. **Press *Run* to start the measurement.**

   The DNA measurement screen is displayed. When the instrument is finished measuring the absorbance of the sample, it displays the absorbance, DNA ratio and DNA concentration similar to the example below.

Note Use the arrow keys to display the next or previous page. ▲

```
TEST NAME:  DNA (260/280)

ID#         ABS(λ1)          ABS(λ2)
            260.0 nm         280.0 nm

1           0.123            0.456
            DNA RATIO        = 1.7
            DNA CONC         = 1234.5 µg/ml
            PROTEIN CONC     = 1111.1 µg/ml

          PRINT    SAVE     TEST     CLEAR
          LIST     DATA     PAGE     RESULTS
```

DNA (260/280) test results

DNA with scan tests

This group includes two tests that function almost identically – the only difference is in the wavelengths range used for the measurements (one measures absorbance between 260 nm and 280 nm; the other between 260 nm and 230 nm.)

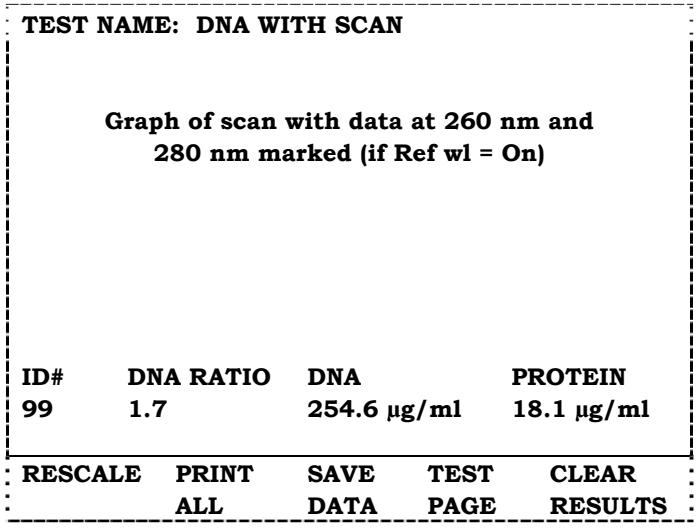
The example below shows the parameters for the DNA with scan (260/280) test. For the DNA with scan (260/230) test, Wavelength 2 is set to 230 nm.

```
                * DNA WITH SCAN *

TEST NAME                              DNA WITH SCAN
WAVELENGTH 1                               260.0 nm
WAVELENGTH 2                               280.0 nm
REF. WAVELENGTH                                OFF
CORRECTION
DNA FACTOR (λ1)                              50.00
DNA FACTOR (λ2)                              0.000
DISPLAY PROTEIN                                NO
DILUTION MULTIPLIER                          1.00
UNITS                                        µg/ml
ID#  (0=OFF)                                    0
AUTOPRINT                                    OFF
USER

SETUP   PRINT    SAVE     STORED    VIEW
SCAN    TEST     TEST     TESTS     RESULTS
```

DNA with scan (260/280) test parameters

1. **Display the appropriate DNA parameter screen and enter the initial sample number (ID#).**
2. **Place the blank in the cell holder.**
3. **Press *Zero/Base* to measure the blank.**
4. **Place the unknown sample in the cell holder.**
5. **Press *Run* to start the measurement.**

   The DNA measurement screen is displayed. The instrument scans the sample and displays a graph of the scan along with the sample ID#, DNA ratio, DNA concentration and protein concentration. Here is an example.



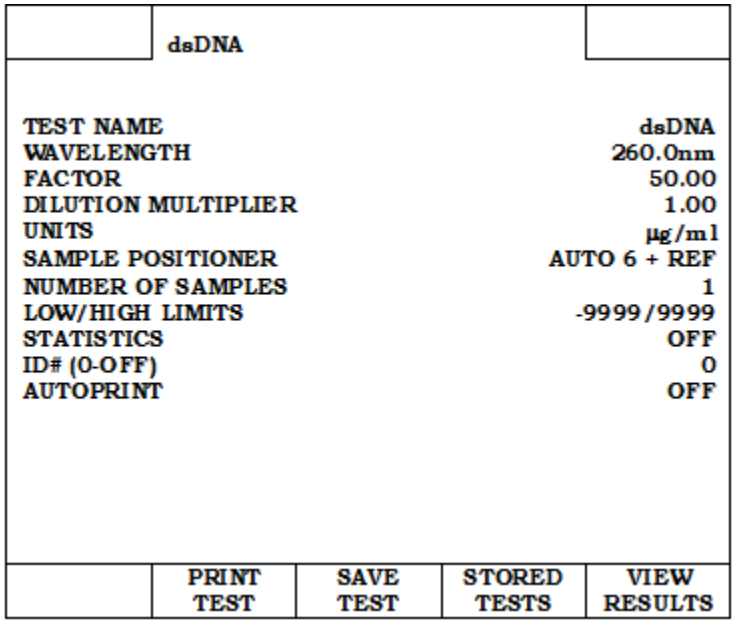
DNA with scan test results

Direct UV measurements of nucleic acids

This group includes:

- DNA/RNA tests
- RNA tests
- Oligonucleotide tests using an entered factor

All of these tests use similar test parameters. For example, the Factor used to convert absorbance to concentration for the direct UV measurement of ssDNA is 50 (see the example below). The Factor is 40 for the direct UV measurement of RNA and 33 for the direct UV measurement of oligonucleotides.

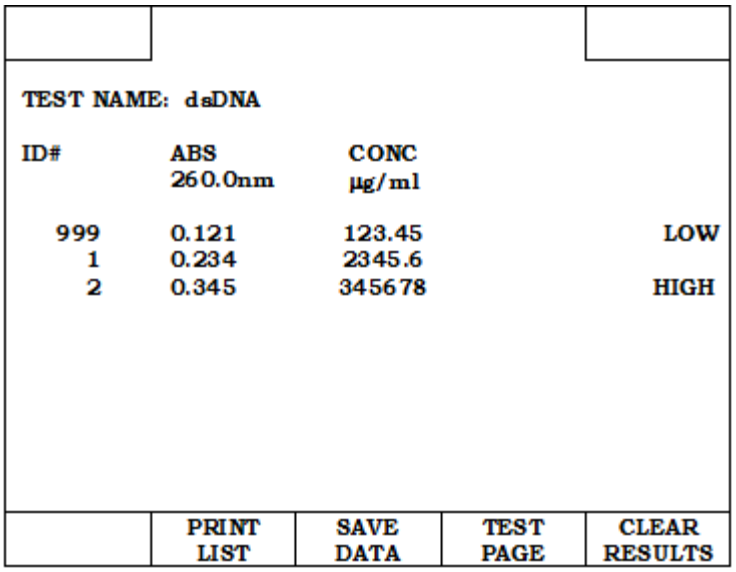


Direct UV measurement of dsDNA test parameters

Running Direct UV measurements of nucleic acids

1. **Display the appropriate Direct UV parameter screen and enter the initial sample number (ID#).**
2. **Place the blank in the cell holder.**
3. **Press *Zero/Base* to measure the blank.**
4. **Place the unknown sample in the cell holder.**
5. **Press *Run* to start the measurement.**

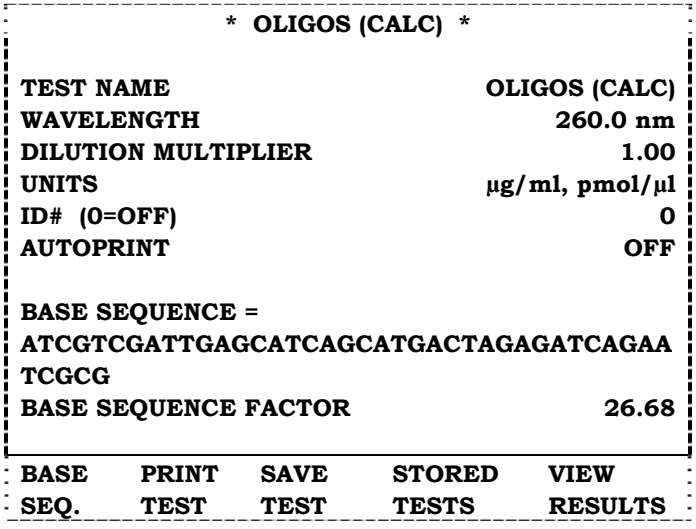
   The Direct UV measurement screen is displayed. When the instrument is finished measuring the absorbance of the sample, it displays the ID#, absorbance and concentration. Here is an example:



Direct UV measurement of ssDNA test results

Oligonucleotide measurement – calculated factor

The Oligonucleotide test with a calculated factor measures absorbance at 260 nm and uses a calculated factor to convert absorbance to concentration. The instrument uses the molecular weight and the extinction coefficient to calculate the factor.



Oligonucleotide test parameters (calculated factor)

1. **Enter a base sequence.**

   With the Oligos (calc factor) parameter screen displayed, press *Base Seq*. to view the Base Sequence screen and then follow the instructions in the Oligo calculator functions section of this manual to specify the sequence.

2. **Enter the initial sample number (ID#).**

3. **Place the blank in the cell holder.**

4. **Press *Zero/Base* to measure the blank.**

5. **Place the unknown sample in the cell holder.**

6. **Press *Run* to start the measurement.**

   The Oligos (calc factor) measurement screen is displayed. When the instrument is finished measuring the absorbance of the sample, it displays the ID#, absorbance and concentration. Here is an example:

Note Use the arrow keys to display the next or previous page. ▲

TEST NAME: OLIGOS (CALC)

ID#	ABS(λ1) 260.0 nm	OLIGOS µg/ml	OLIGOS pmol/µl
999	-0.123	123.4	56.7
1	0.345	12.34	5.67
2	0.678	1.234	0.567
3	1.234	12345	578980

PRINT LIST | SAVE DATA | TEST PAGE | CLEAR RESULTS

Oligonucleotide test results (calculated factor)

Protein measurements – Standard Curve method

These tests can be used to determine the concentration of protein in an unknown sample based on any of the following analytical methods:

Coomassie/Bradford Standard or Coomassie/Bradford Micro – Measures absorbance at 595 nm.

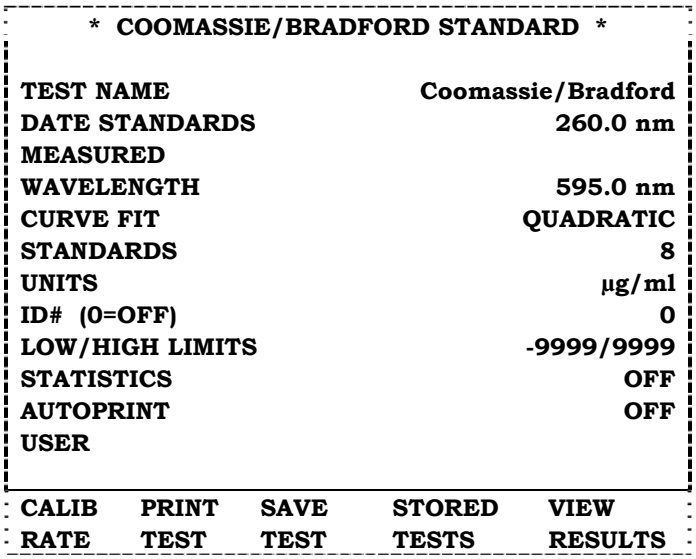
Lowry – Measures absorbance at 550 nm.

Pierce-Modified Lowry – Measures absorbance at 750 nm.

BCA (Bicinchoninic Acid) Standard or Pierce Micro BCA – Measures absorbance at 562 nm.

Biuret - Measures absorbance at 540 nm.

Many of these tests use similar parameters. The example below shows the parameters for the standard Bradford test. For a list of all parameters and calculations for each test, refer to Appendices A and B.



Coomassie/Bradford Standard test parameters

Preparing and running a standard curve

1. **Display the appropriate protein parameter screen and then select *Standards* and press *Enter*.**

2. **Edit any changed concentration values and press *Accept*.**

3. **When all the parameters are correct, press *Calibrate*.**

4. **Follow the on-screen instructions to start the calibration by inserting a blank or standard at each prompt and pressing *Run*.**

   After the instrument has measured the last standard, the Calibration screen shows the absorbance of each standard along with the equation of the calculated standard curve.

Editing a standard curve

You may re-measure any standard on a standard curve, delete specific points from a curve or select a different curve fit.

To edit a standard:

1. **Press *Standards* on the Calibration screen.**

2. **Press *Edit Std* on the Standards Results screen.**

3. **Select the standard you want to edit by entering its number in the pop-up entry box.**

   A pop-up menu appears. Select the option to remove the standard from the calibration, restore a previously ignored value or remeasure the standard's absorbance and follow the on-screen instructions.

To select a different fit for a standard curve:

1. **Press *Standards* on the Calibration screen**

2. **Press *Edit Curve* on the Standards Results screen.**

3. **Select a fit for the standard curve and press *Enter*.**

   The instrument applies the selected curve fit to the data and displays the new calibration equation and coefficient.

Measuring protein

1. **Place the blank in the cell holder.**

2. **With the appropriate protein parameter screen displayed, press *Zero/Base* to measure the blank.**

3. **Place the unknown sample in the cell holder.**

4. **Press *Run*.**

   The protein measurement screen is displayed and the measurement starts. When the instrument is finished measuring the absorbance of the sample, it displays the ID#, absorbance and concentration. Here is an example:

Note Use the arrow keys to display the next or previous page. ▲

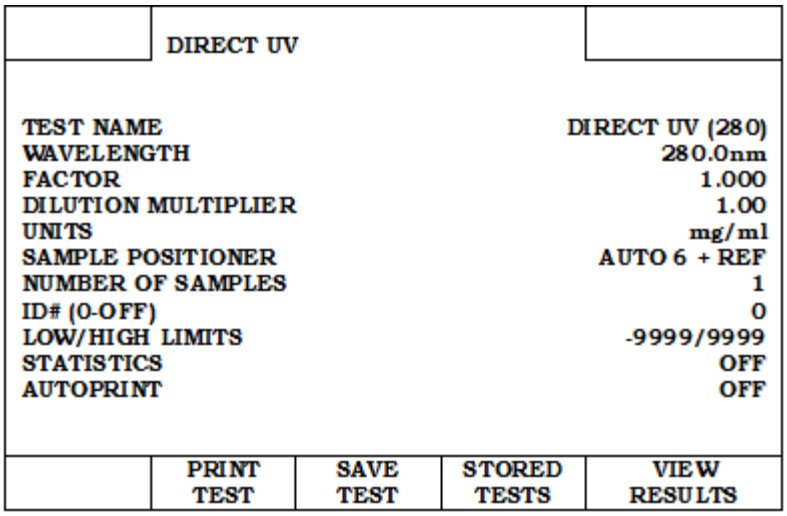
```
TEST NAME:  BRADFORD-STD

ID#         ABS(λ1)          CONC
            260.0 nm         µg/ml

999         0.121            123.45
1           0.234            2345.6
2           0.345            345678


          PRINT    SAVE     TEST      CLEAR
          LIST     DATA     PAGE      RESULTS
```

Coomassie/Bradford Standard test results

Direct UV measurements of proteins

The Direct UV method determines protein concentration based on absorbance at 280 nm or 205 nm.

The example below shows the parameters for the Direct UV protein test at 280 nm. For the Direct UV test at 205 nm, Wavelength is set to 205 nm.



Running Direct UV measurements of proteins

1. **With the appropriate Direct UV parameter screen displayed, enter the initial sample number (ID#).**

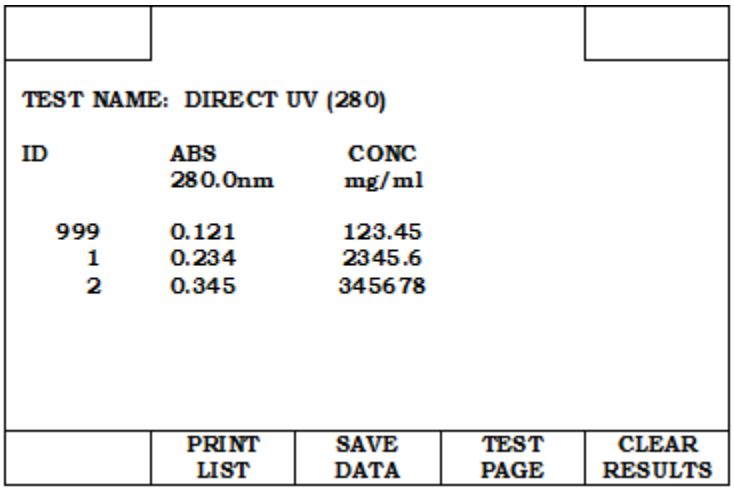
2. **Place the blank in the cell holder.**

3. **Press *Zero/Base* to measure the blank.**

4. **Place the unknown sample in the cell holder.**

5. **Press *Run* to start the measurement.**

   When the instrument is finished measuring the absorbance of the sample, it displays the ID#, absorbance and concentration. Here is an example:



Warburg-Christian test

The Warburg Christian test uses an absorbance difference measurement (at 280 and 260 nm) to determine the concentration of protein in an unknown sample.

```
          * WARBURG-CHRISTIAN *

TEST NAME                    WARBURG-CHRISTIAN
WAVELENGTH 1                          280.0 nm
WAVELENGTH 2                          260.0 nm
PROTEIN FACTOR (λ1)                       1.550
PROTEIN FACTOR (λ2)                       0.760
DILUTION MULTIPLIER                        1.00
UNITS                                     mg/ml
ID#  (0=OFF)                                  0
LOW/HIGH LIMITS                     -9999/9999
STATISTICS                                 OFF
AUTOPRINT                                  OFF
USER

     PRINT     SAVE      STORED     VIEW
     TEST      TEST      TESTS      RESULTS
```

Warburg-Christian test parameters

Running the Warburg-Christian test

1. **With the Warburg-Christian parameter screen displayed, enter the initial sample number (ID#).**

2. **Place the blank in the cell holder.**

3. **Press *Zero/Base* to measure the blank.**

4. **Place the unknown sample in the cell holder.**

5. **Press *Run* to start the measurement.**

   When the instrument is finished measuring the absorbance of the sample, it displays the sample ID#, its absorbance at 280 and 260 nm and its protein concentration. Here is an example:

```
TEST NAME:  WARBURG-CHRISTIAN

ID#         ABS(λ1)          ABS(λ2)
            280.0 nm         260.0 nm

999         0.123            0.456
            PROTEIN CONC       = 1111.1  mg/ml
1           1.234            1.567
            PROTEIN CONC       = 33.8    mg/ml

          PRINT    SAVE     TEST      CLEAR
          LIST     DATA     PAGE      RESULTS
```

Warburg-Christian test results

Cell growth test

The cell growth test uses absorbance at 600 nm to indicate the progress of cell growth in a sample. The instrument does not perform any calculations or graphing for the data.

```
                * CELL GROWTH *

TEST NAME                                CELL GROWTH
WAVELENGTH                                600.00 nm
SAMPLE POSITIONER                             OFF
ID#  (0=OFF)                                   0
LOW/HIGH LIMITS                          -9999/9999
STATISTICS                                    OFF
AUTOPRINT                                     OFF
USER

          PRINT    SAVE     STORED    VIEW
          TEST     TEST     TESTS     RESULTS
```

Cell growth test parameters

Measuring cell growth

1. **Display the cell growth parameter screen and enter the initial sample number (ID#).**
2. **Place the blank in the cell holder.**
3. **Press *Zero/Base* to measure the blank.**
4. **Place the unknown sample in the cell holder.**

5. **Press *Run* to start the measurement.**

   When the instrument is finished measuring the absorbance of the sample, it displays the sample number and absorbance on the screen.

Oligo calculator functions

The oligonucleotide calculator determines the following data for a base sequence that you enter:

- Number of bases
- Percent GC content
- Molecular weight
- Absorptivity (ε)
- Conversion factor to be used in Oligonucleotide measurements
- T_m for oligos up to 20-mers, DNA-DNA hybrids, DNA-RNA hybrids and RNA-RNA hybrids

Specifying a base sequence

You must enter a base sequence before you can run the oligonucleotide calculations.

1. **Display the Base Sequence screen and select the required base.**

2. **Press *Enter* to add the base to the sequence.**

Repeat these steps until you have specified the entire base sequence. The displayed number of bases, percent GC content, molecular weight, absorptivity (ε), and conversion factor will be updated as each new base is added to the sequence.

Using the oligonucleotide calculator

To view the Melting Point calculator, display the Base Sequence screen and press *T_m Calc*. Set the parameters as desired (see Parameter Entry for details).

When you have finished setting parameters, the relevant set of melting point predictions is displayed.

AquaMate Methods

This section applies to the AquaMate spectrophotometers only.

The AquaMate models include a variety of methods to measure specific compounds. The methods determine sample concentration by measuring sample absorbance and then comparing to standards measured at fixed wavelength locations (i.e., the Fixed application) or a concentration curve (i.e., the Quant application).

The tests are provided on a USB memory device. Descriptions of the tests, including the analyte, measurement range, program and file number, are provided at the end of this section.

How to run an AquaMate method

This section gives general information about:

- How to load one of the provided AquaMate methods
- How to save a method to the Library
- The method results

For information about running a specific method, such as one of the Hach or Merck® methods, see the chapter with that name below.

Loading a method

To load an AquaMate method from the Methods USB memory device:

1. **Insert the device into the drive.**
2. **Display the Home screen and select *USB MEM*.**
3. **Select *Load* and press *Enter*.**

To run an AquaMate method from the Library:

1. **Display the Home screen and select *Library*.**
2. **Select a test and press *Enter*.**

After you select a test, the Fixed or Quant screen appears, depending on the file type of the selected file (.QNT or .FXD). The file name of the selected test appears at the top of the screen.

Saving a method to the Library

To save a method to the Library, select *Save To Library*.

Note You can delete the 20 preinstalled methods found in the library to make space for your preferred methods. These 20 methods are also included on the Merck/Hach methods USB memory device in case you need them in the future. ▲

About the method results

Each time you use an AquaMate method to measure a sample, the Fixed Results or Quant Results screen appears (depending on the file type of the method file) with the following information:

- absorbance of the sample
- concentration of the analyte
- Pass/Fail result.

The Pass/Fail result indicates whether the recorded concentration of the sample falls within the measurement range of the test. The Pass/Fail result has three possible states:

Result	Meaning	Solution
Pass	Analyte concentration of the sample is within the measurement range of the selected test.	Save the result.
Fail	Analyte concentration in the sample is too low.	Select a different method with an appropriate range.
FAIL	Analyte concentration is too high.	Select a different method with an appropriate range, or dilute the sample to fit within the measurement range of this method.

Disk 1 - Merck Spectroquant® methods

All the Merck Spectroquant methods are Fixed (.FXD) files, which measure sample absorbance values at fixed wavelengths and compare them to known standards measured at the same locations. The majority of files have the following format:

The methods determine sample concentration by measuring sample absorbance and then comparing to standards measured at fixed wavelength locations (i.e., the Fixed application) or a concentration curve (i.e., the Quant application).

```
14xxxPyy.FXD
```

where:

14xxx	=	Merck Catalog Number
yy	=	Pathlength of cell in nm
FXD	=	Fixed application in software

Note In some cases, the Merck catalog number is of the format 10xxxx. In this case the AquaMate files have the format "0xxxxPyy.FXD". ▲

Operation

Prepare the sample and blank according to the instructions supplied with the test kit.

1. **Load the method (see** Loading a method **for details).**

2. **Place the blank in the cell holder and press *Zero Base* to measure the baseline.**

3. **Insert the prepared sample into the cell holder and press *Run* to measure the sample.**

   The Fixed Results screen appears.

4. **To measure another sample, insert the sample and press *Run*.**

In all but one method (14825P50.FXD) the relationship between absorbance and concentration is linear over the specified measurement range and takes the general form:

```
C = A x FACTOR
```

Therefore, the UV*calc* equation typically takes the following form:

```
  Method: 14566P16.FXD    Zinc

Equation:  M1*4.88
```

The factors entered are those documented by Merck; however, the values of these factors may be affected by local conditions. In all cases, we recommend that you check the factors using standard solutions appropriate to your laboratory and modify the equation accordingly.

Note that the Merck methods do not use timers. You can easily add them, if desired, by referring to the Timer parameter description in the Fixed section of this manual.

Disk 2 – Hach test kit methods

The Hach test kit includes two types of method files:

- .FXD (measures absorbance at up to 20 fixed wavelengths)
- .QNT (compares measured absorbance values against a concentration curve to determine sample concentration).

Instructions for running the Hach methods on the AquaMate are stored in PDF format on this CD.

.FXD method files

The .FXD files have the following format:

`Hxxxx.FXD`

where:

xxxx	=	Hach program number
FXD	=	Fixed application in software

If the Hach method indicates that timers are required, then a number between 1 and 4 will appear next to the Timer(s) option on the Fixed screen.

Operation

Load the method (see Loading a method for instructions). Follow the Hach procedure until the first timer is required. Then continue with the steps below:

1. **Press *Run* to start the first timer.**

Note Some procedures require a zero measurement before the timer sequence is activated. In this case, insert the blank and press *Zero Base* to measure the baseline. Then press *Run* to activate the first timer. ▲

The screen shows the action to be carried out and the time remaining. Here is an example:

```
SHAKE    REMAINING TIME  :  02.46
```

The instrument beeps to indicate the end of the time period and a Timer Finished menu box is displayed with the following options:

- Proceed (starts the next timer)
- Zero (takes a baseline measurement)
- Stop (cancels the current operation)

2. **When you are ready to start the next timer, select *Proceed* and press *Enter*.**

   At the end of this timer, the same Timer Finished menu box is displayed.

3. **If the method requires a zero measurement, insert the blank, select *Zero* and press *Enter*.**

   The instrument measures the baseline and displays a menu box with options to Proceed or Stop.

4. **Insert the sample into the cell holder and select *Proceed*.**

   The instrument measures the sample and displays the Fixed Results screen.

5. **To measure another sample, insert the sample and press *Run*.**

Test results

In all cases the relationship between absorbance and concentration takes the general form:

```
C = A x FACTOR
```

Therefore, the UV*calc* equation typically takes the following form:

```
  Method:  H1310.FXD         Bromine

Equation:  M1 2.25
```

The factors entered are generic. In all cases, we recommend that you check the factors with standard solutions appropriate to your laboratory and modify the equation accordingly.

.QNT method files

The .QNT files have the following format:

```
Hxxxx.QNT
```

where:

xxxx	=	Hach program number
QNT	=	Quant application in software

QNT files are set up for methods that require a calibration graph for each new batch of reagent.

Calibration

Calibrations have been prepared for most of the Hach Quant methods. These methods are ready for use as soon as they have been loaded. However, these calibrations may be affected by local conditions. In all cases, we recommend that you recalibrate with standard solutions appropriate to your laboratory and store the method with a new file name.

In a few cases, new calibrations are required for each reagent batch or plating bath formulation. You must calibrate these methods before you use them.

General instructions for performing a calibration follow below. Specific instructions and details of standard preparation are included in the PDF file for the method.

- To view the standards to be prepared, select *Standards* from the Quant screen and press *Enter*. Compare these standards to those detailed on the Hach procedure sheet. If the preparation of standards requires the same timers as the samples, run the timers by selecting the *Timer(s)* option from the Quant screen and pressing *Run Timers*.

- When the standards are ready for measurement, press *Calibrate*. Follow the on-screen instructions to measure the standards. After all standards have been measured, the calibration graph is displayed along with the coefficient.

- Make sure you save the method file to the Library or USB memory device by pressing *Save Method*. The program is now ready to use for measuring samples.

Load the method (see Loading a method for instructions). Follow the Hach procedure until the first timer is required. Then continue with the steps below:

1. **Press *Run* to start the first timer.**

Note Some procedures require a zero measurement before the timer sequence is activated. In this case, insert the blank and press *Zero Base* to measure the baseline. Then press *Run* to activate the first timer. ▲

The screen shows the action to be carried out and the time remaining. Here is an example:

```
SHAKE    REMAINING TIME  :  02.46
```

The instrument beeps to indicate the end of the time period and a Timer Finished menu box is displayed with the following options:

- Proceed (starts the next timer)
- Zero (takes a baseline measurement)
- Stop (cancels the operation)

2. **To start the next timer, select *Proceed* and press *Enter*.**

   At the end of this timer, the same Timer Finished menu box is displayed.

3. **If the method requires a zero measurement, insert the blank, select *Zero* and press *Enter*.**

   The instrument measures the baseline and displays a menu box with options to Proceed or Stop.

4. **Insert the sample into the cell holder and select *Proceed*.**

   The instrument measures the sample and displays the Fixed Results screen.

5. **To run another sample, insert the sample and press Run.**

The Quant methods automatically take measurements from the calibration graph in concentration units. The UV*calc* equation is therefore of the form:

```
Method:  H1260.QNT         Boron

Equation:  M1
```

In effect, the UV*calc* equation is used to indicate the chemical form and set the measuring range limits.

Disk 3 – Dr. Lange cuvette and pipette test kit methods

All the Dr. Lange cuvette and pipette tests are Fixed (.FXD) methods. These files have the following format:

```
Kxxxyyy.FXD
Wxxxyyy.FXD
```

where:

Kxxx or Wxxx	=	Last four digits of the Lange test kit
FXD	=	Fixed application in software

Operation

Prepare the sample and blank according to the instructions supplied with the test kit.

1. **Load the method (see** Loading a method **for details).**

   The Fixed screen is displayed with the method file name at the top.

2. **Place the blank in the cell holder and press *Zero Base* to measure the baseline.**

3. **Insert the prepared sample into the cell holder and press *Run*.**

   The instrument measures the sample and displays the Fixed Results screen.

4. **To measure another sample, insert the sample and press *Run*.**

Test results

In all methods, the relationship between absorbance and concentration is linear and takes the general form:

```
C = A x FACTOR
```

Therefore, the UV*calc* equation typically takes the following form:

```
Method: K307CT.FXD    Boron

Equation:  M1 1.74
```

The factors entered are those documented by Dr Lange. However, the values of these factors may be affected by local conditions. In all cases, we recommend that you check the factors using standard solutions appropriate to your laboratory and modify the equation accordingly.

Note that timers are not incorporated into the Dr. Lange methods. You can easily add them, if desired, by referring to the Timer parameter description in the Fixed section of this manual.

Disk 4 – CHEMetrics Vacu Vial methods

All the CHEMetrics® Vacu-Vial® methods are Fixed (.FXD) files, which measure sample absorbance values at fixed wavelengths and compare them to known standards measured at the same locations. . These files have the following format:

```
Cxxxx.FXD
```

Operation

Prepare the sample and blank according to the instructions supplied with the test kit.

1. **Load the method (see** Loading a method **for details).**
2. **Place the blank in the cell holder and press *Zero Base* to take a baseline measurement.**
3. **Insert the prepared sample into the cell holder and press *Run* to measure the sample.**
4. **To measure another sample, insert the sample and press *Run*.**

Test results

In all of these methods, the relationship between absorbance and concentration is linear and takes the general form:

```
C = A x FACTOR + INTERCEPT
```

Therefore, the UV*calc* equation typically takes the following form:

```
METHOD: C1603.FXD  Bromine

EQUATION: M1*7.89 + 0.04
```

CHEMetrics determines the Factor and Intercept values specifically for the AquaMate. However, the values of these factors may be affected by local conditions. In all cases, we recommend that you check the factors using standard solutions appropriate to your laboratory and modify the equation accordingly.

Note that the CHEMetrics methods do not use timers. You can easily add them, if desired, by referring to the Timer parameter description in the Fixed section of this manual.

AquaMate method descriptions

This section describes the AquaMate methods in each test kit, including the analyte, test description, type of cell used (when applicable), measurement range, the manufacturer's program number and file name,

Merck

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Alcohol	0.40 - 5.00 g/l	16 mm Round	g/l Alco	14965	14965P16.FXD
	0.40 - 5.00 g/l	10 mm Rectangular	g/l Alco	14965	14965P10.FXD
Aluminum	0.02 - 1.50 mg/l	10 mm Rectangular	mg/l Al	14825	14825P10.FXD
	0.05 - 0.75 mg/l	20 mm Rectangular	mg/l Al	14825	14825P20.FXD
	0.05 - 0.35 mg/l	50 mm Rectangular	mg/l Al	14825	14825P50.FXD
Boron	0.050 - 0.800 mg/l	10 mm Rectangular	mg/l B	14839	14839P10.FXD
Cadmium	0.025 - 1.000 mg/l	16 mm Round	mg/l Cd	14834	14834P16.FXD
	0.025 - 1.000 mg/l	20 mm Rectangular	mg/l Cd	14834	14834P20.FXD
	0.025 - 1.000 mg/l	10 mm Rectangular	mg/l Cd	14834	14834P10.FXD
	0.010 - 0.300 mg/l	50 mm Rectangular	mg/l Cd	14834	14834P50.FXD
Calcium	5 - 80 mg/l	20 mm Rectangular	mg/l Ca	14815	14815P20.FXD
	10 - 160 mg/l 1.0 - 15.0 mg/l*	10 mm Rectangular	mg/l Ca mg/l Ca	14815	14815P10.FXD
Chloride	5 - 125 mg/l	16 mm Round	mg/l Cl^-	14730	14730P16.FXD
	5 - 125 mg/l	20 mm Rectangular	mg/l Cl^-	14730	14730P20.FXD
	5 - 125 mg/l	10 mm Rectangular	mg/l Cl^-	14730	14730P10.FXD
Chlorine	0.01 - 1.50 mg/l	50 mm Rectangular	mg/l Cl_2	14828	14828P50.FXD
	0.05 - 4.00 mg/l	20 mm Rectangular	mg/l Cl_2	14828	14828P20.FXD
	0.10 - 7.50 mg/l	10 mm Rectangular	mg/l Cl_2	14828	14828P10.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Chlorine, Chlorine Dioxide & Ozone	0.01 - 1.00 mg/l 0.02 - 1.00 mg/l 0.01 - 1.00 mg/l	50 mm Rectangular	mg/l Cl_2 mg/l ClO_2 mg/l O_3	14732	14732P50.FXD
	0.05 - 2.50 mg/l 0.05 - 2.50 mg/l 0.05 - 2.50 mg/l	20 mm Rectangular	mg/l Cl_2 mg/l ClO_2 mg/l O_3	14732	14732P20.FXD
	0.10 - 5.00 mg/l 0.10 - 5.00 mg/l 0.10 - 5.00 mg/l	10 mm Rectangular	mg/l Cl_2 mg/l ClO_2 mg/l O_3	14732	14732P10.FXD
Chromium	0.05 - 2.00 mg/l	16 mm Round	mg/l Cr	14552	14552P16.FXD
	0.05 - 2.00 mg/l	20 mm Rectangular	mg/l Cr	14552	14552P20.FXD
	0.05 - 2.00 mg/l	10 mm Rectangular	mg/l Cr	14552	14552P10.FXD
	0.010 - 0.600 mg/l	50 mm Rectangular	mg/l Cr	14758	14758P50.FXD
	0.03 - 1.50 mg/l	20 mm Rectangular	mg/l Cr	14758	14758P20.FXD
	0.05 - 3.00 mg/l	10 mm Rectangular	mg/l Cr	14758	14758P10.FXD
COD, Oxygen Demand, Chemical	4.0 - 40.0 mg/l	16 mm Round	mg/l COD	14560	14560P16.FXD
	10 - 150 mg/l	16 mm Round	mg/l COD	14540	14540P16.FXD
	15 - 300 mg/l	16 mm Round	mg/l COD	14895	14895P16.FXD
	50 - 500 mg/l	16 mm Round	mg/l COD	14690	14690P16.FXD
	100 - 1500 mg/l	16 mm Round	mg/l COD	14541	14541P16.FXD
	300 - 3500 mg/l	16 mm Round	mg/l COD	14691	14691P16.FXD
	500 - 10000 mg/l	16 mm Round	mg/l COD	14555	14555P16.FXD
Copper	0.10 - 8.00 mg/l	16 mm Round	mg/l Cu	14553	14553P16.FXD
	0.05 - 3.00 mg/l	20 mm Rectangular	mg/l Cu	14553	14553P20.FXD
	0.10 - 6.00 mg/l	10 mm Rectangular	mg/l Cu	14553	14553P10.FXD
	0.02 - 1.20 mg/l	50 mm Rectangular	mg/l Cu	14767	14767P50.FXD
	0.05 - 3.00 mg/l	20 mm Rectangular	mg/l Cu	14767	14767P20.FXD
	0.10 - 6.00 mg/l	10 mm Rectangular	mg/l Cu	14767	14767P10.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Cyanide	0.010 - 0.500 mg/l	16 mm Round	mg/l CN^-	14561	14561P16.FXD
	0.005 - 0.250 mg/l	20 mm Rectangular	mg/l CN^-	14561	14561P20.FXD
	0.010 - 0.500 mg/l	10 mm Rectangular	mg/l CN^-	14561	14561P10.FXD
	0.002 - 0.100 mg/l	50 mm Rectangular	mg/l CN^-	14800	14800P50.FXD
	0.005 - 0.250 mg/l	20 mm Rectangular	mg/l CN^-	14800	14800P20.FXD
	0.010 - 0.500 mg/l	10 mm Rectangular	mg/l CN^-	14800	14800P10.FXD
	0.002 - 0.100 mg/l	50 mm Rectangular	mg/l CN^-	109701	09701P50.FXD
	0.005 - 0.250 mg/l	20 mm Rectangular	mg/l CN^-	109701	09701P20.FXD
	0.010 - 0.500 mg/l	10 mm Rectangular	mg/l CN^-	109701	09701P10.FXD
Fluoride	0.10 - 1.50 mg/l	16 mm Round	mg/l F^-	14557	14557P16.FXD
	0.10 - 1.50 mg/l	20 mm Rectangular	mg/l F^-	14557	14556P20.FXD
	0.10 - 1.50 mg/l	10 mm Rectangular	mg/l F^-	14557	14557P10.FXD
	0.025 - 0.500 mg/l	50 mm Rectangular	mg/l F^-	14557	14557P50.FXD
Formaldehyde	0.1 - 10.0 mg/l	16 mm Round	mg/l HCHO	14500	14500P16.FXD
	0.05 - 6.00 mg/l	20 mm Rectangular	mg/l HCHO	14500	14500P20.FXD
	0.1 - 10.0 mg/l	10 mm Rectangular	mg/l HCHO	14500	14500P10.FXD
	0.02 - 1.50 mg/l	50 mm Rectangular	mg/l HCHO	14678	14678P50.FXD
	0.05 - 4.00 mg/l	20 mm Rectangular	mg/l HCHO	14678	14678P20.FXD
	1.00 - 9.00 mg/l	10 mm Rectangular	mg/l HCHO	14678	14678P10.FXD
Gold	0.5 - 12.0 mg/l	10 mm Rectangular	mg/l Au	14821	14821P10.FXD
Hardness, Residual		16 mm Round	mg/l Ca	14683	14683P16.FXD
	0.25 - 2.50 mg/l	20 mm Rectangular	mg/l Ca	14683	14683P20.FXD
	0.50 - 5.00 mg/l	10 mm Rectangular	mg/l Ca	14683	14683P10.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Hardness, Total	5 - 150 mg/l	16 mm Round	mg/l Ca	14565	14565P16.FXD
	5 - 100 mg/l	20 mm Rectangular	mg/l Ca	14565	14565P20.FXD
	5 - 150 mg/l	10 mm Rectangular	mg/l Ca	14565	14565P10.FXD
Hydrazine	0.02 - 1.00 mg/l	50 mm Rectangular	mg/l N_2H_4	14797	14797P50.FXD
	0.10 - 2.50 mg/l	20 mm Rectangular	mg/l N_2H_4	14797	14797P20.FXD
	0.20 - 5.00 mg/l	10 mm Rectangular	mg/l N_2H_4	14797	14797P10.FXD
	0.005 - 0.400 mg/l	50 mm Rectangular	mg/l N_2H_4	109711	09711P50.FXD
	0.01 - 1.00 mg/l	20 mm Rectangular	mg/l N_2H_4	109711	09711P20.FXD
	0.02 - 2.00 mg/l	10 mm Rectangular	mg/l N_2H_4	109711	09711P10.FXD
Hydrogen Peroxide	2.0 - 20.0 mg/l	16 mm Round	mg/l H_2O_2	14731	14731P16.FXD
	0.25 - 5.00 mg/l	50 mm Rectangular	mg/l H_2O_2	14731	14731P50.FXD
	2.0 - 20.0 mg/l	10 mm Rectangular	mg/l H_2O_2	14731	14731P10.FXD
Iron	0.05 - 4.00 mg/l	16 mm Round	mg/l Fe	14549	14549P16.FXD
	0.03 - 2.50 mg/l	20 mm Rectangular	mg/l Fe	14549	14549P20.FXD
	0.05 - 5.00 mg/l	10 mm Rectangular	mg/l Fe	14549	14549P10.FXD
	0.005 - 1.000 mg/l	50 mm Rectangular	mg/l Fe	14761	14761P50.FXD
	0.03 - 2.50 mg/l	20 mm Rectangular	mg/l Fe	14761	14761P20.FXD
	0.05 - 5.00 mg/l	10 mm Rectangular	mg/l Fe	14761	14761P10.FXD
	1.0 - 50.0 mg/l	16 mm Round	mg/l Fe	14896	14696P16.FXD
	1.0 - 50.1 mg/l	20 mm Rectangular	mg/l Fe	14896	14896P20.FXD
	1.0 - 50.0 mg/l	10 mm Rectangular	mg/l Fe	14896	14896P10.FXD
Lead	0.10 - 5.00 mg/l	16 mm Round	mg/l Pb	14833	14833P16.FXD
	0.10 - 5.00 mg/l	20 mm Rectangular	mg/l Pb	14833	14833P20.FXD
	0.10 - 5.00 mg/l	10 mm Rectangular	mg/l Pb	14833	14833P10.FXD
Magnesium	5.0 - 50.0 mg/l	16 mm Round	mg/l Mg	14684	14684P16.FXD
	5.0 - 50.0 mg/l	20 mm Rectangular	mg/l Mg	14684	14684P20.FXD
	5.0 - 50.0 mg/l	10 mm Rectangular	mg/l Mg	14684	14684P10.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Manganese	0.01 - 2.00 mg/l	50 mm Rectangular	mg/l Mn	14770	14770P50.FXD
	0.25 - 5.00 mg/l	20 mm Rectangular	mg/l Mn	14770	14770P20.FXD
	0.50 - 10.00 mg/l	10 mm Rectangular	mg/l Mn	14770	14770P10.FXD
Nickel	0.10 - 6.00 mg/l	16 mm Round	mg/l Ni	14554	14554P16.FXD
	0.05 - 2.50 mg/l	20 mm Rectangular	mg/l Ni	14554	14554P20.FXD
	0.10 - 5.00 mg/l	10 mm Rectangular	mg/l Ni	14554	14554P10.FXD
	0.05 - 2.00 mg/l	50 mm Rectangular	mg/l Ni	14785	14785P50.FXD
	0.20 - 5.00 mg/l	20 mm Rectangular	mg/l Ni	14785	14785P20.FXD
	0.10 - 5.00 mg/l	10 mm Rectangular	mg/l Ni	14785	14785P10.FXD
Nitrogen, Ammonia	0.01 - 2.00 mg/l 0.01 - 2.60 mg/l	16 mm Round	mg/l NH_4-N mg/l NH_4^+	14739	14739P16.FXD
	0.01 - 2.00 mg/l 0.01 - 2.60 mg/l	10mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14739	14739P10.FXD
	0.20 - 8.00 mg/l 0.30 - 10.00 mg/l	16 mm Round	mg/l NH_4-N mg/l NH_4^+	14558	14558P16.FXD
	0.20 - 8.00 mg/l 0.30 - 10.00 mg/l	10 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14558	14558P10.FXD
	0.5 - 16.0 mg/l 0.6 - 21.0 mg/l	16 mm Round	mg/l NH_4-N mg/l NH_4^+	14544	14544P16.FXD
	0.5 - 16.0 mg/l 0.6 - 21.0 mg/l	10 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14544	14544P10.FXD
	4.0 - 80.0 mg/l 5.0 - 100.0 mg/l	16 mm Round	mg/l NH_4-N mg/l NH_4^+	14559	14559P16.FXD
	4.0 - 80.0 mg/l 5.0 - 100.0 mg/l	10 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14559	14559P10.FXD
	0.010 - 0.500 mg/l 0.010 - 0.650 mg/l	50 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14752	14752P50.FXD
	0.03 - 1.50 mg/l 0.04 - 1.90 mg/l	20 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14752	14752P20.FXD
	0.05 - 3.00 mg/l 0.06 - 3.90 mg/l	10 mm Rectangular	mg/l NH_4-N mg/l NH_4^+	14752	14752P10.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Nitrogen, Nitrate	0.11 - 3.40 mg/l 0.5 - 15.0 mg/l	16 mm Round	mg/l NO_3-N mg/l NO_3^-	14556	14556P16.FXD
	0.05 - 1.50 mg/l 0.25 - 6.50 mg/l	20 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14556	14556P20.FXD
	0.10 - 3.00 mg/l 0.5 - 13.0 mg/l	10 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14556	14556P10.FXD
	1.0 - 50.0 mg/l 4 - 220 mg/l	16 mm Round	mg/l NO_3-N mg/l NO_3^-	14764	14764P16.FXD
	1.0 - 50.0 mg/l 4 - 220 mg/l	10 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14764	14764P10.FXD
	0.5 - 18.0 mg/l 2.0 - 80.0 mg/l	16 mm Round	mg/l NO_3-N mg/l NO_3^-	14542	14542P16.FXD
	0.02 - 10.0 mg/l 1.0 - 45.0 mg/l	20 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14542	14542P20.FXD
	0.5 - 20.0 mg/l 2.0 - 90.0 mg/l	10 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14542	14542P10.FXD
	0.5 - 25.0 mg/l 2 - 110 mg/l	16 mm Round	mg/l NO_3-N mg/l NO_3^-	14563	14563P16.FXD
	0.25 - 12.5 mg/l 1.0 - 55.0 mg/l	20 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14563	14563P20.FXD
	0.5 - 25.0 mg/l 2 - 110 mg/l	10 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14563	14563P10.FXD
	0.2 - 10.0 mg/l 1.0 - 45.0 mg/l	20 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14773	14773P20.FXD
	0.5 - 20.0 mg/l 2.0 - 90.0 mg/l	10 mm Rectangular	mg/l NO_3-N mg/l NO_3^-	14773	14773P10.FXD
Nitrogen, Nitrite	0.020 - 0.610 mg/l 0.05 - 2.00 mg/l	16 mm Round	mg/l NO_2-N mg/l NO_2^-	14547	14547P16.FXD
	0.010 - 0.500 mg/l 0.03 - 1.60 mg/l	20 mm Rectangular	mg/l NO_2-N mg/l NO_2^-	14547	14547P20.FXD
	0.020 - 1.000 mg/l 0.100 - 3.00 mg/l	10 mm Rectangular	mg/l NO_2-N mg/l NO_2^-	14547	14546P10.FXD
	0.005 - 0.200 mg/l	50 mm Rectangular	mg/l NO_2-N	14776	14776P50.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
	0.015 - 0.650 mg/l		mg/l NO_2^-		
	0.010 - 0.500 mg/l 0.03 - 1.60 mg/l	20 mm Rectangular	mg/l NO_2-N mg/l NO_2^-	14776	14776P20.FXD
	0.02 - 1.00 mg/l 0.10 - 3.00 mg/l	10 mm Rectangular	mg/l NO_2-N mg/l NO_2^-	14776	14776P10.FXD
Nitrogen, Total	0.5 - 15.0 mg/l	16 mm Round	mg/l N	14537	14537P16.FXD
	0.3 - 10.0 mg/l	20 mm Rectangular	mg/l N	14537	14537P20.FXD
	0.5 - 15.0 mg/l	10 mm Rectangular	mg/l N	14537	14537P10.FXD
	10 - 150 mg/l	16 mm Round	mg/l N	14763	14763P16.FXD
	10 - 150 mg/l	10 mm Rectangular	mg/l N	14763	14763P10.FXD
Oxygen, Dissolved	0.5 - 12.0 mg/l	16 mm Round	mg/l O_2	14694	14694P16.FXD
	0.5 - 12.0 mg/l	20 mm Rectangular	mg/l O_2	14694	14694P20.FXD
	0.5 - 12.0 mg/l	10 mm Rectangular	mg/l O_2	14694	14694P10.FXD
Phenols	0.10 - 2.50 mg/l	16 mm Round	mg/l phenol	14551	14551P16.FXD
	0.025 - 1.000 mg/l	50 mm Rectangular	mg/l phenol	14551	14551P50.FXD
	0.10 - 2.50 mg/l	20 mm Rectangular	mg/l phenol	14551	14551P20.FXD
	0.10 - 2.50 mg/l	10 mm Rectangular	mg/l phenol	14551	14551P10.FXD
Phosphorus, PMB	0.01 - 1.00 mg/l 0.05 - 3.00 mg/l	50 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14848	14848P50.FXD
	0.03 - 2.50 mg/l 0.10 - 7.50 mg/l	20 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14848	14848P20.FXD
	0.05 - 5.00 mg/l 0.2 - 15.0 mg/l	10 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14848	14848P10.FXD
	0.05 - 5.00 mg/l 0.2 - 15.3 mg/l	16 mm Round	mg/l PO_4-P mg/l PO_4^{3-}	14543	14543P16.FXD
	0.03 - 2.50 mg/l 0.10 - 7.50 mg/l	20 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14543	14543P20.FXD
	0.05 - 5.00 mg/l 0.2 - 15.0 mg/l	10 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14543	14543P10.FXD
	0.5 -25 mg/l	16 mm Round	mg/l PO_4-P	14729	14729P16.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
	1.5 - 75.0 mg/l		mg/l PO_4^{3-}		
	0.5 -25 mg/l 1.5 - 75.0 mg/l	10 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14729	14729P10.FXD
Phosphorus, VM	0.5 - 25.0 mg/l 1.5 - 75.0 mg/l	16 mm Round	mg/l PO_4-P mg/l PO_4^{3-}	14546	14546P16.FXD
	0.5 - 15.0 mg/l 1.5 - 45.0 mg/l	20 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14546	14546P20.FXD
	1.0 - 30.0 mg/l 3.0 - 90.0 mg/l	10 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14546	14546P10.FXD
	0.5 - 15.0 mg/l 1.5 - 45.0 mg/l	20 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14842	14842P20.FXD
	1.0 - 30.0 mg/l 3.0 - 90.0 mg/l	10 mm Rectangular	mg/l PO_4-P mg/l PO_4^{3-}	14842	14842P10.FXD
Potassium	5.0 - 50.0 mg/l	16 mm Round	mg/l K	14562	14562P16.FXD
	5.0 - 50.0 mg/l	20 mm Rectangular	mg/l K	14562	14562P20.FXD
	5.0 - 50.0 mg/l	10 mm Rectangular	mg/l K	14562	14562P10.FXD
Silica	0.005 - 0.750 mg/l	50 mm Rectangular	mg/l Si	14794	14794P50.FXD
	0.05 - 2.50 mg/l	20 mm Rectangular	mg/l Si	14794	14794P20.FXD
	0.1 - 5.00 mg/l	10 mm Rectangular	mg/l Si	14794	14794P10.FXD
Silver	0.25 - 1.50 mg/l	20 mm Rectangular	mg/l Ag	14831	14831P20.FXD
	0.50 - 3.00 mg/l	10 mm Rectangular	mg/l Ag	14831	14831P10.FXD
Sulphate	5 - 250 mg/l	16 mm Round	mg/l SO_4^{2-}	14548	14548P16.FXD
	5 - 250 mg/l	20 mm Rectangular	mg/l SO_4^{2-}	14548	14548P20.FXD
	5 - 250 mg/l	10 mm Rectangular	mg/l SO_4^{2-}	14548	14548P10.FXD
	100 - 1000 mg/l	16 mm Round	mg/l SO_4^{2-}	14564	14564P16.FXD
	100 - 1000 mg/l	20 mm Rectangular	mg/l SO_4^{2-}	14564	14564P20.FXD
	100 - 1000 mg/l	10 mm Rectangular	mg/l SO_4^{2-}	14564	14564P10.FXD
	25 - 300 mg/l	10 mm Rectangular	mg/l SO_4^{2-}	14791	14791P10.FXD
Sulphide	0.020 - 0.500 mg/l	50 mm Rectangular	mg/l S^{2-}	14779	14779P50.FXD

Analyte	Range	Cell Type	Units	Program	AquaMate File Name
Sulphite	0.05 - 3.00 mg/l	50 mm Rectangular	mg/l SO_3^{2-}	14394	14394P50.FXD
	0.5 - 15.0 mg/l	20 mm Rectangular	mg/l SO_3^{2-}	14394	14394P20.FXD
	1.0 - 25.0 mg/l	10 mm Rectangular	mg/l SO_3^{2-}	14394	14394P10.FXD
	1.0 - 25.0 mg/l	16 mm Round	mg/l SO_3^{2-}	14394	14394P16.FXD
Surfactants Determination	0.05 - 2.0 mg/l	16 mm Round	mg/l MBAS	14697	14697P16.FXD
Tin	0.10 - 2.50 mg/l	16 mm Round	mg/l Sn	14622	14622P16.FXD
	0.10 - 1.50 mg/l	20 mm Rectangular	mg/l Sn	14622	14622P20.FXD
	0.10 - 2.50 mg/l	10 mm Rectangular	mg/l Sn	14622	14622P10.FXD
Zinc	0.050 - 0.500 mg/l	50 mm Rectangular	mg/l Zn	14566	14566P50.FXD
	0.20 - 5.00 mg/l	20 mm Rectangular	mg/l Zn	14566	14566P20.FXD
	0.20 - 5.00 mg/l	10 mm Rectangular	mg/l Zn	14566	14566P10.FXD
	0.20 - 5.00 mg/l	16 mm Round	mg/l Zn	14566	14566P16.FXD
	0.05 - 2.50 mg/l	10 mm Rectangular	mg/l Zn	14832	14832P10.FXD

Hach

Analyte	Method	Range	Program	AquaMate File Name
Aluminum	Eriochrome Cyanine R	0 - 0.250 mg/l	1010	H1010.QNT
	Aluminum	0 - 0.800 mg/l	1000	H1000.QNT
Arsenic	Silver Diethyldithiocarbamate	0 - 0.200 mg/l	1050	H1050.QNT
Barium	Turbidimetric	0 - 100 mg/l	1100	H1100.QNT
	Turbidimetric (AccuVac)	0 - 100 mg/l	1110	H1110.QNT
Boron	Carmine	0 - 14.0 mg/l	1250	H1250.QNT
	AzoMethine-H	0 - 1.5 mg/l	1260	H1260.QNT
Bromine	DPD	0 - 4.50 mg/l	1300	H1300.FXD
	DPD (AccuVac)	0 - 4.50 mg/l	1310	H1310.FXD
Cadmium	Dithizone	0 - 80 µg/l	1350	H1350.QNT
Chloride	Mercuric Thiocyanate	0 - 25.0 mg/l	1400	H1400.QNT
Chlorine, Free	DPD	0 - 2.00 mg/l	1450	H1450.FXD
	DPD (AccuVac)	0 - 2.00 mg/l	1460	H1460.FXD
	DPD	0 - 5.00 mg/l	1470	H1470.FXD
	DPD (TNT)	0 - 5.00 mg/l	1480	H1480.FXD
Chlorine, Total	DPD	0 - 2.00 mg/l	1450	H1450.FXD
	DPD (AccuVac)	0 - 2.00 mg/l	1460	H1460.FXD
	DPD	0 - 5.00 mg/l	1470	H1470.FXD
	DPD (TNT)	0 - 5.00 mg/l	1480	H1480.FXD
Chlorine Dioxide	Chlorophenol Red	0 - 1.00 mg/l	1500	H1500.FXD
	Direct Reading	0 - 50 mg/l	1510	H1510.FXD
	Direct Reading	0 - 1000 mg/l	1520	H1520.FXD
Chromium, Hexavalent	1,5-Diphenylcarbohydrazide	0 - 0.700 mg/l	1560	H1560.QNT
	1,5-Diphenylcarbohydrazide	0 - 0.700mg/l	1570	H1570.QNT

Analyte	Method	Range	Program	AquaMate File Name
Chromium, Total	Alkaline Hypobromite Oxidation	0 - 0.700 mg/l	1580	H1580.QNT
Chromium, Trivalent	Direct Reading	0 - 20.0 g/l	1550	H1550.FXD
Cobalt	PAN	0 - 2.00 mg/l	1600	H1600.QNT
COD, Oxygen Demand,	Reactor Digestion	0 - 40 mg/l	2700	H2700.QNT
Chemical	Reactor Digestion	0 - 150 mg/l	2710	H2710.QNT
	Reactor Digestion (Hg Free)	0 - 150 mg/l		H2715.QNT
	Reactor Digestion	0 - 1500 mg/l	2720	H2720.QNT
	Reactor Digestion (Hg Free)	0 - 1500 mg/l		H2725.QNT
	Reactor Digestion	0 - 15 g/l	2720	H2720+.QNT
	Manganese III	20 - 1000mg/l	2730	H2730.QNT
Color, True and Apparent	Platinum-Cobalt	0 - 500 units	1670	H1670.QNT
	Platinum-Cobalt	0 - 500 units	1680	H1680.QNT
Copper	Porphyrin	0 - 210.0 µg	1720	H1720.QNT
	Bicinchoninate	0 - 5.000 mg/l	1700	H1700.QNT
	Bicinchoninate (AccuVac)	0 - 5.000 mg/l	1710	H1710.QNT
Copper, Autocatalytic	Colorimetric	0 - 3.00 g/l	1690	H1690.QNT
Cyanide	Pyridine-Pyrazalone	0 - 0.240 mg/l	1750	H1750.QNT
Detergents, Anionic	Crystal Violet	0 - 0.275 mg/l	1850	H1850.QNT
Fluoride	SPADNS	0 - 2.00 mg/l	1900	H1900.QNT
	SPADNS (AccuVac)	0 - 2.00 mg/l	1910	H1910.QNT
Formaldehyde	MBTH	0 - 500 µg/l	1950	H1950.QNT
Hardness	Chlorophosphonazo	0 - 1000 µg/l	2000	H2000.FXD
Hardness, Calcium or	Calmagite, Colorimetric	0 - 4.00 mg/l	2020 (Mg)	H2020.QNT

Analyte	Method	Range	Program	AquaMate File Name
Magnesium			2010 (Ca)	H2010.QNT
Hydrazine	p-Dimethylamino-benzaldehyde	0 - 600 µg/l	2050	H2050.QNT
	p-Dimethylamino-benzaldehyde (AccuVac)	0 - 600 µg/l	2060	H2060.QNT
Iodine	DPD	0 - 7.00 mg/l	2100	H2100.FXD
	DPD (AccuVac)	0 - 7.00 mg/l	2110	H2110.FXD
Iron, Total	FerroZine	0 - 1.400 mg/l	2175	H2175.QNT
	FerroMo	0 - 1.800 mg/l	2160	H2160.QNT
	TPTZ	0 - 1.800 mg/l	2190	H2190.QNT
	TPTZ (AccuVac)	0 - 1.800 mg/l	2195	H2195.QNT
	FerroVer	0 - 3.00 mg/l	2165	H2165.QNT
	FerroVer (AccuVac)	0 - 3.00 mg/l	2170	H2170.QNT
Iron, Ferrous	1,10-Phenanthroline	0 - 3.00 mg/l	2150	H2150.QNT
	1,10-Phenanthroline (AccuVac)	0 - 3.00 mg/l	2155	H2155.QNT
Lead	Fast Column Extraction (LeadTrak)	0 - 150 µg/l	2210	H2210.QNT
	Dithizone	0 - 300 µg/l	2200	H2200.QNT
Manganese	PAN	0 - 0.700 mg/l	2260	H2260.QNT
	Periodate Oxidation	0 - 20.0 mg/l	2250	H2250.QNT
Molybdenum, Molybdate	Ternary Complex	0 - 3.00 mg/l	2300	H2300.QNT
	Mercaptoacetic Acid	0 - 50.0 mg/l	2310	H2310.QNT
	Mercaptoacetic Acid (AccuVac)	0 - 50.0 mg/l	2320	H2320.QNT
Nickel	Heptoxime	0 - 1.80 mg/l	2360	H2360.QNT
Nickel, Autocatalytic	Photometric	0 - 8.00 g/l	2350	H2350.QNT
Nitrogen, Ammonia	Salicylate	0 - 0.80 mg/l	2455	H2455.QNT
	Nessler (TNT)	0 - 2.50 mg/l	2400	H2400.QNT
	Salicylate (TNT)	0 - 2.500 mg/l	2460	H2460.QNT
	Salicylate (TNT)	0 - 50.0 mg/l	2465	H2465.QNT

Analyte	Method	Range	Program	AquaMate File Name
Nitrogen, Monochloramine and free ammonia	Salicylate (PP or AccuVac)	0 - 0.50 mg/l	2470	H2470.FXD
Nitrogen, Nitrate	Cadmium Reduction	0 - 0.50 mg/l	2515	H2515.QNT
	Cadmium Reduction	0 - 5.0 mg/l	2520	H2520.QNT
	Cadmium Reduction (AccuVac)	0 - 5.0 mg/l	2525	H2525.QNT
	Cadmium Reduction	0 - 30.0 mg/l	2530	H2530.QNT
	Cadmium Reduction (AccuVac)	0 - 30.0 mg/l	2535	H2535.QNT
	Chromotropic Acid (TNT)	0 - 30.0 mg/l	2511	H2511.QNT
Nitrogen, Nitrite	Diazotization	0-0.3000 mg/l	2610	H2610.FXD
	Diazotization (AccuVac)	0-0.3000 mg/l	2620	H2620.FXD
	Diazotization (TNT)	0-0.5000 mg/l	2630	H2630.FXD
	Ferrous Sulphate	0 - 250 mg/l	2600	H2600.FXD
Nitrogen, Total Inorganic	Titanium Reduction (TNT)	0 - 25.0 mg/l	2550	H2550.QNT
Nitrogen, Total Kjeldahl	Nessler	0 - 150 mg/l	2410	H2410.QNT
Nitrogen, Total	Persulphate Digestion (TNT)	0 - 25 mg/l	2558	H2558.QNT
Palladium	N,N'-Dimethyldithiooxamide	0 - 250 mg/l	2850	H2850.QNT
Phenols	4-Aminoantipyrine	0 - 0.200 mg/l	2900	H2900.QNT
Phosphonates	Persulphate/UV Oxidation	0 - 2.50 to 0 - 125 mg/l	2950	H2950.QNT
Phosphorus, Reactive	PhosVer 3, Ascorbic Acid	0 - 2.500 mg/l	3025	H3025.QNT
	PhosVer 3, (AccuVac)	0 - 2.500 mg/l	3030	H3030.QNT
	PhosVer 3 (TNT)	0 - 5.00 mg/l	3035	H3035.QNT
	Amino Acid	0 - 30.00 mg/l	3010	H3010.QNT
	Molybdovanadate	0 - 45.00 mg/l	3015	H3015.QNT
	Molybdovanadate (AccuVac)	0 - 45.00 mg/l	3020	H3020.QNT
Phosphorus, Total	PhosVer 3 (TNT)	0 - 3.50 mg/l	3036	H3036.QNT

Analyte	Method	Range	Program	AquaMate File Name
Phosphorus, Acid Hydrolyzable	Ascorbic Acid (TNT)	0 - 5.00 mg/l	3037	H3037.QNT
Platinum	N,N'-Dimethyldithiooxamide	0 - 10 g/l	3150	H3150.QNT
Potassium	Colorimetric	0 - 7.0 mg/l	3100	H3100.QNT
Quaternary Ammonium Compounds	Direct Binary Complex	0 - 5.00 mg/l	3200	H3200.QNT
Selenium	Diaminobenzidine	0 - 1.000 mg/l	3300	H3300.QNT
Silica	Heteropoly Blue	0 - 1.600 mg/l	3360	H3360.QNT
	Silicomolybdate	0 - 100 mg/l	3350	H3350.QNT
Silver	Colorimetric	0 - 0.700 mg/l	3400	H3400.FXD
Sulphate	SulfaVer 4	0 - 70.0 mg/l	3450	H3450.QNT
	SulfaVer 4 (AccuVac)	0 - 70.0 mg/l	3460	H3460.QNT
Sulphide	Methylene Blue	0 - 800 µg/l	3500	H3500.FXD
Tannin and Lignin	Tyrosine	0 - 9.0 mg/l	3550	H3550.QNT
Turbidity	Radiation Attenuation	0 - 5000 FAU	3750	H3750.QNT
Volatile Acid	Esterification	0 - 2800 mg/l	3800	H3800.QNT
Zinc	Zincon	0 - 3.000 mg/l	3850	H3850.QNT

Lange

Analyte	Range	Units	Cell	Program	AquaMate File Name
BOD Oxygen demand, biological (5 day)	0.5-12 mg/l	BOD5	11 mm Round	LCK554	K554CT.FXD
Carbonate/Carbon dioxide	55 - 550 mg/l	CO_2	11mm Round	LCK 388	K388CT.FXD
Chloride	70-1000 mg/l	Cl^-	11mm Round	LCK 311	K311CT.FXD
Chlorine, Total	0.05 - 1.5 mg/l 0.05 - 1.5 mg/l	mg/l Cl_2 mg/l O_3	11mm Round	LCW 510	W510RC.FXD
	0.03 - 0.4 mg/l 0.03 - 0.4 mg/l	mg/l Cl_2 mg/l O_3	50 mm Rectangular	LCW 510	W510P50.FXD
Chromium	0.03 - 1.0 mg/l	mg/l Cr	11 mm Round	LCK 313	K313CT.FXD
	0.005 - 0.25 mg/l	mg/l Cr	50 mm Rectangular	LCK 313	K313P50.FXD
COD, Oxygen Demand, Chemical	15 - 150 mg/l	mg/l COD	11 mm Round	LCK 314	K314CT.FXD
	50 - 300 mg/l	mg/l COD	11 mm Round	LCK 614	K614CT.FXD
	150 - 1000 mg/l	mg/l COD	11 mm Round	LCK 114	K114CT.FXD
	100 - 2000 mg/l	mg/l COD	11 mm Round	LCK 514	K514CT.FXD
	5 - 60 g/l	g/l COD	11 mm Round	LCK 914	K914CT.FXD
Copper	0.01 - 1.0 mg/l	mg/l COD	11 mm Round	LCK 529	K529CT.FXD
	0.1 - 8.0 mg/l	mg/l COD	11 mm Round	LCK 329	K329CT.FXD
Cyanide	0.01 - 0.60 mg/l	mg/l CN	11 mm Round	LCK 315	K315CT.FXD
	0.01 - 0.60 mg/l	mg/l CN	11 mm Round	LCK 316	K316CT.FXD
Detergents, Anionic	0.01 - 0.80 mg/l	DE	50 mm Rectangular	LCW 017	W017P50.FXD
	0.1 - 2.0 mg/l	DE	10 mm Rectangular	LCW 017	W017P10.FXD
Formaldehyde	0.01 - 1.0 mg/l	mg/l HCHO	50 mm Rectangular	LCK 325	K325P50.FXD
	0.5 - 10.0 mg/l	mg/l HCHO	11 mm Round	LCK 325	K325CT.FXD
Hydrazine	0.01 - 2.0 mg/l	mg/l N_2H_4	10 mm Rectangular	LCW 025	W025P10.FXD
Iron	0.01 - 1.0 mg/l	mg/l Fe	11 mm Round	LCK 521	K521CT.FXD

Analyte	Range	Units	Cell	Program	AquaMate File Name
	0.2 - 6.0 mg/l	mg/l Fe	11 mm Round	LCK 321	K321CT.FXD
	0.2 - 6.0 mg/l	mg/l Fe(II)	11 mm Round	LCK 320	K320CT.FXD
Manganese	0.02 - 1.0 mg/l	mg/l Mn	50 mm Rectangular	LCW 032	W032P50.FXD
	0.2 - 5.0 mg/l	mg/l Mn	10 mm Rectangular	LCW 032	W032P10.FXD
Nickel	0.05 - 1.0 mg/l	mg/l Ni	50 mm Rectangular	LCK 537	K537P50.FXD
	0.1 - 6.0 mg/l	mg/l Ni	11 mm Round	LCK 337	K337CT.FXD
Nitrogen, Ammonia	0.02 - 2.50 mg/l 0.015 - 2.0 mg/l	NH_4 NH_4-N	11 mm Round	LCK 304	K304CT.FXD
	1.3 - 15.0 mg/l 1 - 12 mg/l	NH_4 NH_4-N	11 mm Round	LCK 305	K305CT.FXD
	2.5 - 60.0 mg/l 2 - 47 mg/l	NH_4 NH_4-N	11 mm Round	LCK 303	K303CT.FXD
	60 - 167 mg/l 47 - 130 mg/l	NH_4 NH_4-N	11 mm Round	LCK 302	K302CT.FXD
Nitrogen, Nitrate	1 - 60 mg/l 0.23 - 13.50 mg/l	NO_3 NO_3-N	11 mm Round	LCK 339	K339CT.FXD
	22 - 155 mg/l 5 - 35 mg/l	NO_3 NO_3-N	11 mm Round	LCK 340	K340CT.FXD
Nitrogen, Nitrite	0.05 - 2.0 mg/l 0.015 - 0.6 mg/l	NO_2 NO_2-N	11 mm Round	LCK 341	K341CT.FXD
	0.005 - 0.100 mg/l 0.002 - 0.030 mg/l	NO_2 NO_2-N	50 mm Rectangular	LCK 341	K341P50.FXD
	2 - 20 mg/l 0.6 - 6.0 mg/l	NO_2 NO_2-N	11 mm Round	LCK 342	K342CT.FXD
Nitrogen, Total Kjeldahl	1 – 10 mg/l 10 – 200 mg/l 200 – 2000 mg/l	mg/l TKN mg/l TKN mg/l TKN	11 mm Round	LCW909	W909CT.FXD
Phenols	0.05 - 5.0 mg/l	Phenol	11 mm Round	LCK 345	K345CT.FXD
Organic Complexing Agents	3 – 20 mg/l NTA	NTA	11 mm Round	LCW907	W907CT.FXD

Analyte	Range	Units	Cell	Program	AquaMate File Name
Orthophosphate	5 - 90 mg/l 1.6 - 30.0 mg/l 3.7 - 70.0 mg/l	PO_4 PO_4-P P_2O_5	11 mm Round	LCK 049	K049CT.FXD
Phosphorus, Total	0.01 – 0.50 mg/l 0.03 – 1.50 mg/l 0.02 – 1.20 mg/l	PO_4-P PO_4 P_2O_5	50 mm Rectangular	LCK349	K349P50.FXD
	0.05 - 1.50 mg/l 0.15 - 4.50 mg/l 0.15 - 3.50 mg/l	PO_4-P PO_4 P_2O_5	11 mm Round	LCK 349	K349CT.FXD
	0.5 - 5.0 mg/l 1.5 - 15.0 mg/l 1.2 - 11.5 mg/l	PO_4-P PO_4 P_2O_5	11 mm Round	LCK 348	K348CT.FXD
	2 - 20 mg/l 6 - 60 mg/l 4.5 - 45.0 mg/l	PO_4-P PO_4 P_2O_5	11 mm Round	LCK 350	K350CT.FXD
Potassium	8 - 50 mg/l	K	11 mm Round	LCK 328	K328CT.FXD
Silicic Acid	0.01 - 0.80 mg/l 0.005 - 0.40 mg/l	SiO_2 Si	50 mm Rectangular	LCW 028	W028P50.FXD
	0.8 – 20 mg/l 0.4 – 10 mg/l 20 – 100 mg/l 10 – 50 mg/l	SiO_2 Si SiO_2 Si	11 mm Round		W028CT.FXD
Silver	5 - 400 mg/l 400–2500 mg/l	Ag	11 mm Round	LCK 355	K355CT.FXD
Sulphate	40 - 150 mg/l	SO_4	11 mm Round	LCK 153	K153CT.FXD
Sulphide	0.1 - 2.0 mg/l	S^{2-}	10 mm Rectangular	LCW 053	W053P10.FXD
Sulphite	0.1 - 5.0 mg/l	SO_3	10 mm Rectangular	LCW 054	W054P10.FXD
Surfactants Determination	0.2 - 2.0 mg/l		11 mm Round	LCK 332	K332CT.FXD
	0.5 - 25.0 mg/l		50 mm Rectangular	LCW 018	W018P50.FXD
Zinc	0.02 – 0.80 mg/l	Zn	11 mm Round	LCK360	K360CT.FXD

CHEMetrics

Analyte	Method	Range	Program	AquaMate File Name
Ammonia	Nessler	0 - 7mg/l	1503	C1503.FXD
(Nitrogen)	Nessler	0 - 14mg/l	1523	C1523.FXD
Bromine	DDPD	0 - 9 mg/l	1603	C1603.FXD
Chlorine	DDPD	0 - 4mg/l	2503	C2503.FXD
	DPD	0 - 6mg/l	2513	C2513.FXD
Chlorine Dioxide	DPD	0 - 11mg/l	2703	C2703.FXD
Chromate	Diphenylcarbazide	0 - 3.5mg/l	2803	C2803.FXD
	Diphenylcarbazide	0 - 7mg/l	2823	C2823.FXD
Copper	Bathocuproine	0 - 7mg/l	3503	C3503.FXD
	Bathocuproine	0 - 14mg/l	3523	C3523.FXD
Cyanide	Isonicotinic barbituric acid	0 - 0.4mg/l	3803	C3803.FXD
DEHA	PDTS	0 - 2mg/l	3903	C3903.FXD
Formaldehyde	Purpald	0 - 8mg/l	4203	C4203.FXD
Glycol	Purpald	0 - 10mg/l	4403	C4403.FXD
Hydrazine	PDMAB	0 - 0.7mg/l	5003	C5003.FXD
Iron	Phenanthroline	0 - 6mg/l	6003	C6003.FXD
	PDTS	0 - 2.5mg/l	6023	C6023.FXD
	Phenanthroline	0 -12mg/l	6013	C6013.FXD
Molybdate	Catechol	0 - 25mg/l	6703	C6703.FXD
Nitrate	Cd Reduction/Chromotrophic Acid	0 - 1.5mg/l	6903	C6903.FXD
	Cd Reduction/Chromotrophic Acid	0 - 3mg/l	6923	C6923.FXD
	Cd Reduction/Chromotrophic Acid	0 - 60mg/l	6933	C6933.FXD
Nitrite	Azo dye	0 - 0.8mg/l	7003	C7003.FXD
COD	Reactor Digestion	0 - 150mg/l	7350	C7350.FXD
Oxygen Demand,	Reactor Digestion	0 - 1500mg/l	7360	C7360.FXD

Analyte	Method	Range	Program	AquaMate File Name
Chemical	Reactor Digestion	0-15000mg/l	7370	C7370.FXD
Oxygen	Indigo carmine	0 - 2mg/l	7503	C7503.FXD
	Indigo carmine	0 - 15mg/l	7513	C7513.FXD
	Rhodazine D	0 - 0.8mg/l	7553	C7553.FXD
Ozone	DDPD	0 - 2mg/l	7403	C7403.FXD
Peracetic Acid	DDPD	0 - 4mg/l	7903	C7903.FXD
Peroxide	DDPD	0 - 2mg/l	5503	C5503.FXD
	DDPD	0 - 4mg/l	5543	C5543.FXD
Phenols	4-Aminoantipyrine	0 - 8mg/l	8003	C8003.FXD
	4-Aminoantipyrine	0 - 16mg/l	8023	C8023.FXD
Phosphate	Vanadomolybdophosphoric Acid	0 - 40mg/l	8503	C8503.FXD
	Stannous Chloride	0 - 5mg/l	8513	C8513.FXD
Silica	Heteropoly Blue	0 - 4mg/l	9003	C9003.FXD
Sulphide	Methylene Blue	0 - 1.5mg/l	9503	C9503.FXD
	Methylene Blue	0 - 3mg/l	9523	C9523.FXD
Zinc	Zincon	0 - 3.0mg/l	9903	C9903.FXD
	Zincon	0 - 6.0mg/l	9923	C9923.FXD

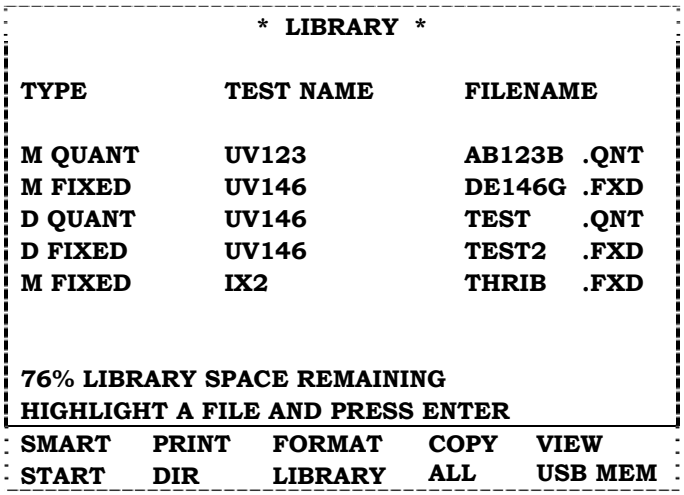
Library

The Local Control Software stores methods and data files in a library. The term “library” refers to an area of instrument memory called the “instrument library” and any USB memory device that is formatted as a library.

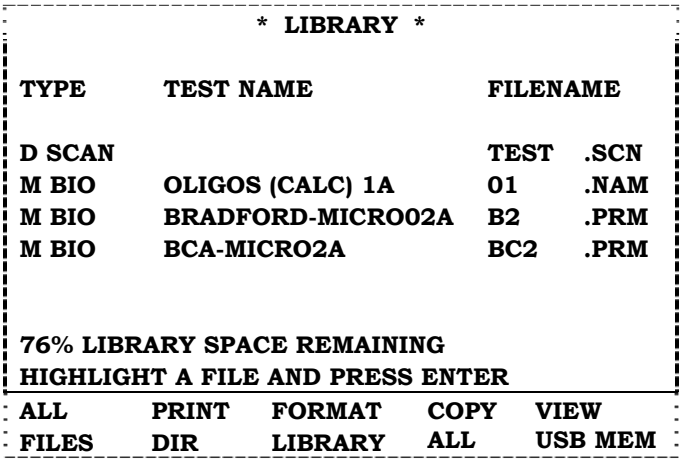
You can save files to both types of libraries from the method or results screen of any Local Control Software application.

Instrument Library screen

To display the instrument library screen, select *Library* on the Home screen and press *Enter*. The instrument displays the file name, file type and description of each library file. Here are some examples:



Instrument library screen for all instruments except the BioMate 6



Instrument library screen for the BioMate 6

Use the arrow keys to display the next or previous page.

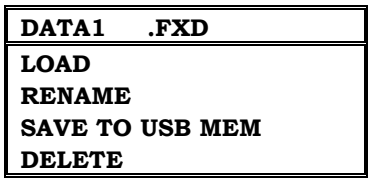
Note There may be a short delay while the instrument loads the next section of the directory. ▲

Parameter	Function
Type	Describes the file and the type of information it contains. Here are some examples: M Scan — Scan method D Scan — Spectrum, data and method M Fixed — Fixed wavelength method D Fixed — Fixed wavelength results and method M Quant — Quant method, including calibration D Quant — Quant results, including method and calibration M Rate — Rate method D Rate — Rate graphics, data and method M MCA — MCA method D MCA — MCA results M Bio — BioMate test D Bio — BioMate test and results Type is assigned automatically depending on the application used to create the file and the file's contents.
Test Name	Shows the descriptive name that was entered when the file was saved (see Test Name in the method screen for any Local Control Software application).
Filename	Shows the DOS-compatible file name used by the instrument or computer. You can edit or rename the file. See Working with Files Stored in the Instrument Library for details.

Function key	Description
View USB MEM	Displays the directory for the USB memory device that is currently in the drive.
Copy All	Copies all files from the instrument library to the installed USB memory device. **Note**: Before you select this option, install a compatible USB memory device that has available space.
Format Library	DELETES all files from the instrument library.
Print Dir	Prints the directory for the instrument library.
Smart Start	Available on all instruments except the BioMate 6. Select a file to be displayed in the start-up menu and press *Enter*. The start-up menu will appear when the instrument is turned on (instead of the default Home screen). Press *Home* to see the new start-up screen. From the start-up screen, press General Tests to display the default Home screen.
All Files /Results Only	Available on BioMate 6 models only. Toggles between two display formats: methods and results combined, or results only.

Working with files stored in the instrument library

To perform an operation on a library file, select the file and press *Enter*. The Instrument Library pop-up menu is displayed:



Select an option and press *Enter*.

Menu Option	Function
Load	Loads the selected method or displays the selected results.
Rename	Displays the Save/Rename screen where file name can be changed.
Save to USB MEM	Copies the selected file to the installed USB memory device.
Delete	Removes the selected file from the instrument library.

USB Memory Device Library screen

To display the library screen for the installed USB Memory Device, insert the device, display the Instrument Library screen and select *View USB Mem*. The instrument displays the file name, file type and description of each library file.

Use the arrow keys to display the next or previous page.

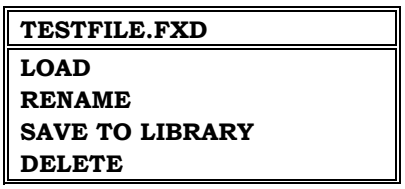
Note There may be a short delay while the instrument loads the next section of the directory. ▲

Parameter	Function
Type	Describes the file and the type of information it contains. See Instrument Library screen for examples. Type is assigned automatically depending on the application used to create the file and the file's contents.
Test Name	Shows the descriptive name that was entered when the file was saved (see Test Name in the method screen for any Local Control Software application).
Filename	Shows the DOS-compatible file name used by the instrument or computer. You can edit or rename the file. See Working with Files Stored on a USB Memory Device for details.

Function key	Description
View Library	Displays the directory for the instrument library.
Read USB Mem	Refreshes the directory for the installed USB memory device.
Print Dir	Prints the directory for the installed USB memory device.
Copy All	Copies all files from the installed USB memory device to the instrument library.

Working with files stored on a USB Memory device

To perform an operation on a library file, select the file and press *Enter*. The USB Library pop-up menu is displayed:



Select an option and press *Enter*.

Parameter	Function
Load	Loads the selected method or displays the selected results.
Rename	Displays the Save/Rename screen so you can save the file with a different file name and description.
Save to Library	Copies the selected file to the instrument library.
Delete	Removes the selected file from the installed USB memory device.

UV*calc*

Quantitative analytical procedures are built around two fundamental principles, measurement of the parameter, and subsequent calculations based on these measurements.

In UV-Visible spectrophotometry and many other 'mature' analytical techniques, the science associated with the measurement of the parameter is well developed. There are fully-validated 'test kits' available from the leading chemical suppliers in the key areas of bio-chemical and environmental/water chemistry. In addition, most laboratories also have their own fully-developed internal procedures.

With defined procedures, many 'standard methods' document the final calculation in the form of an algebraic formula. UV*calc* allows these formulae to be entered into the software method, together with the control limits.

UV*calc* provides automatic calculation of results from measurements using user-defined equations. The measurement is obtained from the spectrometer in the form of a reading at a specific wavelength in Scan methods and individual results in Fixed and Quant methods.

Specification

Up to 4 different equations may be applied to each measurement.

The formula editor supports +, -, *, /, and bracketing.

Allowed operands include measurements, constants (entered via the numeric keypad), fixed & variable factors (input by the user at run-time) and UV*calc* results from preceding equations.

Each formula may have up to 20 characters.

Each formula supports up to 9 terms including measurements, constants, variable factors and results.

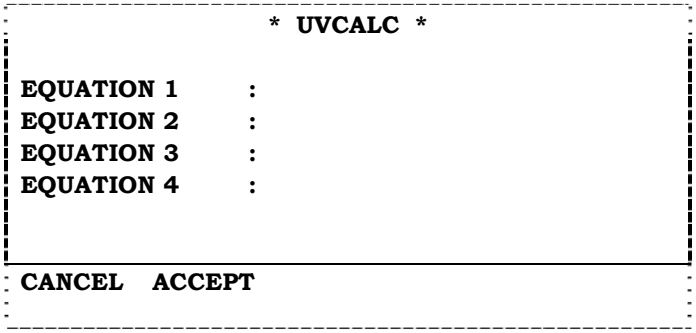
Equations are automatically saved with the method. If you save sample results that are produced with a method that contains calculations, the calculations are also saved with the sample data.

Equations, results, units and pass/fail results are included on the hard copy output.

Operation

When the UV*calc* software is installed, the instrument adds the UV*calc* option to the Scan, Fixed and Quant screens. When no equations are programmed, the UV*calc* field is set to 0.

Select UV*calc* and press *Enter* to display a list of up to four UV*calc* equations (empty when first installed).



To create or edit an equation, select an equation in the list and press *Enter*. The equations parameters screen is displayed in the following format:

Formula
Title
Units
Test Result: No
Upper Limit: 0.000
Lower Limit: 0.000

There will also be lines specific to the particular application (Scan, Fixed or Quant).

Option	Function
Formula	Defines the terms and operands in the formula.
Title	Specifies a name for the formula. Use the Text Entry screen to enter a name and press *Accept*.
Units	Gives the units for the equation. Use the Text Entry screen to enter a name and press *Accept*.
Test Result	Toggles between Yes and No.
Upper/Lower Limit	Define the allowable limits for the test.

Function key	Description
Accept	Stores the entered settings.
Cancel	Displays the Equations screen without storing your entries.

Defining a formula

To enter a formula, select *Formula* and press *Enter*. The instrument displays a simulated keyboard with the following symbols:

λ or M	F	R	(	)
+	-	*	/	Space

Each symbol represents an available formula term or operand (see the table below for definitions). Use the symbols to build a formula. To add a term or operand to the formula, select the corresponding symbol and press Enter.

Option	Function
λ or M	λ (for UV*calc* from a Scan Method)- Displays a pop-up entry box to define the wavelength for the measurement. M (for UVcalc from a Fixed or Quant method)- Displays a pop up menu with the following options: **Once Only (Constant)** – Measures this value the first time and then uses that value for subsequent calculations. **Measure Each Run** – Measures this value each time.
F	Defines a factor. Each factor can be fixed or variable (can be entered by the user at run time).
R	UV*calc* result from preceding equations.
(and)	Can be used to group terms and operands.
+, -, *, /	Adds the corresponding operand (add, subtract, multiply, divide) to the formula.
Space	Adds a space to the formula.

Function key	Description
←	Clears the last character in the formula.
Switch Fields	Toggles the cursor between the formula and the simulated keyboard.
Accept	Stores the entered settings.
Cancel	Displays the Equations screen without storing your entries.

To clear the entire formula, press *C*.

To store the formula as displayed, press *Accept*. The Equations screen is displayed with the new formula listed in the next available line.

Setting up a Scan calculation

Up to 9 different measurements may be specified for each Scan UV*calc* equation. These are denoted by 1……9. The wavelengths at which these measurements are made can be specified in one of 2 ways. They can be entered numerically before the scan, or they can be entered after the scan using a peak picking process. This appears as an extra parameter on the equation parameter screen (Use Tracking). The selected wavelengths will then be fed into the method so that the subsequent final result will be calculated automatically.

If a factor is used only once in a calculation, the instrument prompts the operator to input the factor before the first scan.

Note If you subsequently move from the Results/Graph screens back to the main menu, the one-off factors will be reset and must be re-entered before the next run. ▲

This example shows how to set up the following Scan calculation:

$\lambda 1/\lambda 2 * F$

1. **Display the Scan method parameters.**

   For this example, set Start to 400 nm and Stop to 600 nm.

2. **Select *UVcalc* and press *Enter***

3. **Select *Equation 1* and press *Enter*.**

4. **Select *Formula* and press *Enter*.**

5. **Select λ and press *Enter*.**

6. **Enter *450* for the first wavelength and press *Enter*.**

7. **Select / and press *Enter*.**

8. **Select λ and press *Enter*.**

9. **Enter *500* and press *Enter*.**

10. **Select * and press *Enter*.**

11. **Select *F* and press *Enter*.**

    A pop-up menu is displayed with the following options:

    - Fixed Factor
    - Variable Factor

12. **Select *Variable Factor* and press *Enter*.**

13. **Enter a suitable ID and press *Accept*.**

    The formula displayed at the top of the screen should look like this:

    FORMULA : λ1/λ2*F1

14. **Press *Accept* to complete the formula.**

15. **Select Title, enter a descriptive name to be displayed in the UVCALC Equations screen and press *Accept*.**

16. **Select Units, enter appropriate units for the equation and press *Accept*.**

17. **Press *Accept* again to complete the equation.**

    The new equation is displayed in the Equations screen:

    MY CALC : λ1/λ2*F1

18. **Press *Accept* again to return to the Scan parameters screen.**

19. **Insert the sample and press *Run*.**

20. **Enter a factor at the prompt and press *Accept*.**

The instrument scans the sample and displays the results of the calculation.

Setting up a Fixed calculation

Up to 9 different measured results may be specified for each UV*calc* equation. These measurements will comprise a combination of up to 9 different one-off measurements (measured at the start of the run only) and one measurement which will be re-measured each time *Run* is pressed.

This example shows how to set up the following Fixed calculation:

M1 *50.0

1. **Display the Fixed method parameters, select UV*calc* and press *Enter*.**

2. **Select *Equation 1* and press *Enter*.**

3. **Select *Formula* and press *Enter*.**

4. **Select *M* and press *Enter*.**

   The instrument displays a pop-up menu with the following options:

   - Once only – constant
   - Measure each RUN

5. **Select *Measure each RUN* and press *Enter*.**

6. **Select * and press *Enter*.**

7. **Enter *50* and press *Accept*.**

   The formula displayed at the top of the screen should look like this:

   FORMULA : M1 * 50

8. **Select Title, enter a descriptive name to be displayed in the UVCALC Equations screen and press *Accept*.**

9. **Select Units, enter appropriate units for the equation and press *Accept*.**

10. **Press *Accept* to complete the equation.**

    The new equation is displayed in the Equations screen:

    MY CALC : M1 * 50

11. **Press *Accept* again to return to the Fixed parameters screen.**

12. **Insert the sample and press *Run*.**

    The instrument measures the sample and displays the actual absorbance value and the result of the calculation.

Setting up a Quant calculation

You can specify up to 9 different measurements. These measurements may be a standard (S1…S6) (measured as part of the normal calibration process) or a sample (X).

Note One-off factors will be cleared if you select *Clear Results* from the results screen or if you return to the main menu. ▲

Modifying an equation by adding parameters

This example shows how to add parameters to the end of an equation (e.g., adds a weight correction to M1*50).

M1*50.0*(F1/F2)

where: F1 = Nominal weight (Fixed Factor)
F2 = Actual weight (Variable Factor)

1. **Display the Fixed method parameters, select *UVcalc* and press *Enter*.**
2. **Select *Equation 1* and press *Enter*.**

   The equation prepared above is displayed.

   M1 *50.0

3. **Select *Formula* and press *Enter*.**

   The cursor moves to the end of the existing formula.

4. **Select * and press *Enter*.**
5. **Select (and press *Enter*.**
6. **Select *F* and press *Enter*.**
7. **Select *Fixed Factor* and press *Enter*.**
8. **Enter a suitable ID for the factor and press *Accept*.**
9. **Select / and press *Enter*.**
10. **Select *F* and press *Enter*.**
11. **Select *Variable Factor* and press *Enter*.**
12. **Enter a suitable ID for the factor and press *Accept*.**
13. **Select) and press *Enter*.**

14. **Press *Accept* to display the main *UVcalc* screen.**

    The formula displayed at the top of the screen should look like this:

    FORMULA : M1 * 50 * (F1/F2)

15. **Press *Accept* twice to display the Fixed parameters screen.**

16. **Insert the sample and press *Run*.**

17. **Enter a factor at the prompt and press *Accept*.**

Modifying an equation by adding constants

This example shows how to add constants to an equation (e.g., adds a second constant to M1*50).

(M2-M1)*50.0

where: M1 = becomes a once only constant
M2 = measure with each run

1. **Display the Fixed method parameters, select UV*calc* and press *Enter*.**

2. **Select *Equation 1* and press *Enter*.**

   The equation prepared above is displayed.

   M1 *50.0

3. **Select *Formula* and press *Enter*.**

   The cursor moves to the end of the existing formula.

4. **Press *Switch Fields* to select the formula, move the cursor to M1 and press *Enter*.**

5. **Change the selection to *Once Only – Constant* and press *Enter*.**

6. **Press *Switch Fields* to select the simulated keyboard.**

7. **Select (and press *Enter*.**

8. **Select M, press *Enter*, select *Measure with each RUN* and press *Enter*.**

9. **Select "-" (minus) and press *Enter*.**

10. **Press *Switch Fields* and move the cursor to the *.**

11. **Press *Switch Fields* again, select) and press *Enter*.**

12. **Press *Accept*.**

    The formula displayed at the top of the screen should look like this:

    FORMULA : (M2-M1) * 50

13. **Make appropriate entries for Title and Units.**

14. **Press *Accept* twice to display the Fixed parameters screen.**

UV*calc* Error Messages

The following error messages may occur if you make a mistake in entering an equation or in setting up the system.

Error Message	Problem
ONLY 1 FACTOR MAY BE ENTERED WITH SAMPLE	Formula has two or more factors for each sample.
THIS FORMULA HAS TOO MANY CONSTANTS	Formula has more than 9 numbers.
FORMULA CONTAINS AN INVALID NUMBER	Formula has an invalid input.
BRACES DO NOT MATCH IN FORMULA	Formula has too many brackets at one end.
ALL BINARY OPERATIONS REQUIRE TWO OPERANDS	Formula has an incomplete arithmetical operation (e.g., 3-+4).
INVALID COMBINATION OF OPERANDS	You have created a formula with missing user(s) (e.g. F1(M1)).
BRACE MISSING?- UNMATCHED CLOSE BRACE	Closing bracket appears before or without an open bracket.
THE FORMULA CANNOT START WITH THIS TOKEN	Quant mode formula has an invalid initial token; i.e., a user rather than an operand.
FORMULA CONTAINS OUT OF RANGE STANDARD	A specified standard is no longer in the calibration.
ONLY ONE MULTIPLE MEASUREMENT IS ALLOWED	Fixed mode formula has an invalid initial token.
FORMULA CONTAINS INVALID RESULT TOKEN	The result from an earlier calculation is no longer being produced.

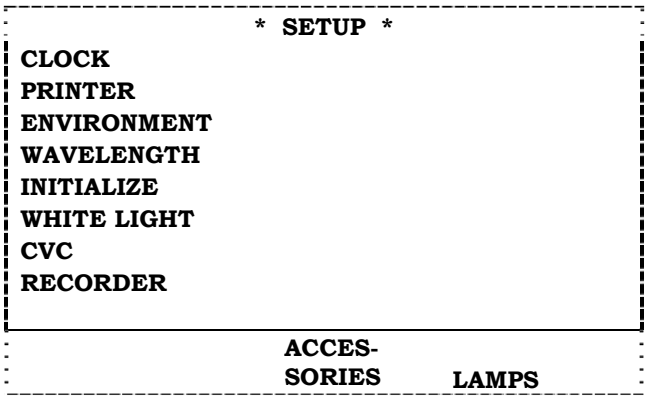
Error Message	Problem
UVCALC :INVALID CELL CHANGER MODE	An invalid Cell Changer mode has been selected. Check settings.
FORMULA CONTAINS OUT OF RANGE WAVELENGTH	You have selected wavelengths outside the range set for the scan.

Setup

Use the Setup function key on the Home screen to access general instrument parameters. Select a parameter in the list and choose *Enter*.

To change a parameter setting, select the parameter and press *Enter*. See Parameter Entry for more information.

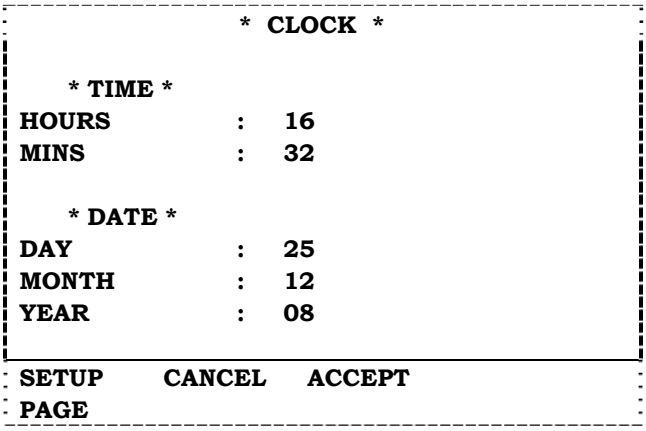
Setup screen



Parameter	Function
Clock	Sets the internal time and date.
Printer	Selects the printer type.
Environment	Sets language, date format, file type, autosave, autoprint, and user log-on options.
Wavelength	Used for wavelength recalibration.
Initialize	Defines instrument initialization and default baseline.
White Light	Sets zero order for alignment of sample holders.
CVC	Loads CVC calibration data.
Recorder	Allows analog data output.

Function key	Description
Accessories	Displays a pop-up menu to access parameters for accessories such as the Cell Changer or sipper.
Lamps	Shows lamp status and energy levels, turns lamps on and off, and resets lamp hours. See Lamps screen for more information.

Clock screen

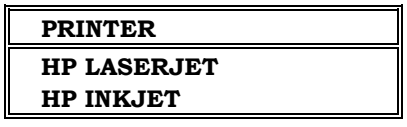


Select this option to set the instrument's internal time and date. To reset a parameter, select the parameter and press *Enter* to display a pop-up entry box. Type the new value and press *Enter*. When you are finished setting parameters, press *Accept* to save the new settings or *Cancel* to exit without saving. Press *Setup Page* to return to the Setup screen.

Printer menu options

Select this option to set up a printer. The Printer Type is displayed and is set to the currently selected printer.

To change the selected printer, press *Enter*. A pop-up menu is displayed with a list of supported printers. Select a printer and press *Enter*.



Menu Option	Description
HP LaserJet	HP LaserJet Series with PCL 3 only.
HP InkJet	HP InkJet Series with PCL 3 only.

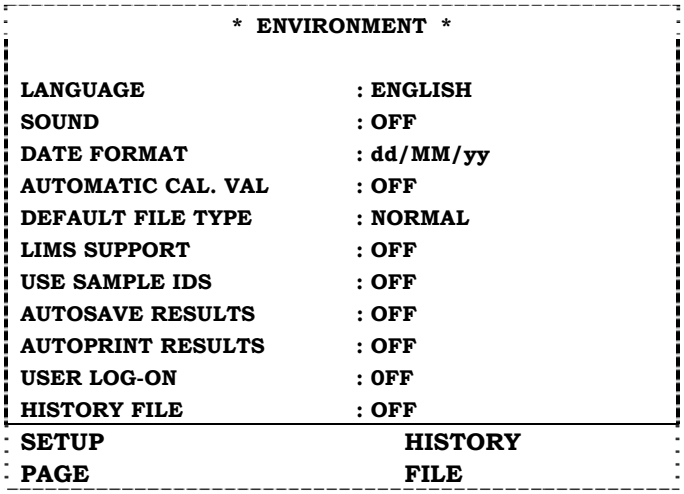
Function key	Description
Setup Page	Displays the Setup screen.

Note Printers designed to work only in a Windows® environment may not be compatible with Local Control software. ▲

Before you attempt to print at any point during operation of the instrument, make sure the printer is ready to print (i.e., power is on, printer is on-line, paper is loaded). Failure to do so will result in an error condition. Press *ESC* to clear the error message. Then correct the problem with the printer and try again.

Environment screen

Use this screen to turn the beeper on and off and set the date format, the language used for the software and the default file type used to save results. You can also enable or disable automatic calibration verification, LIMS (Laboratory Information Management System) output and the UV*calc* application. These parameters are described in more detail below.



Function key	Description
History File	Appears only when the History File option is enabled.
Change Users	Appears only when User Log-On is enabled and is available only to the system administrator.
UVcalc Off	Appears only when the UVcalc application is installed. Disables UVcalc and re-enables functions that UVcalc disables.
Setup Page	Displays the Setup screen.

Language

Sets the language used on the display. A pop-up menu lists the available languages. Select an option and press *Enter*. The language used immediately changes to the one selected.

Sound

Toggles the audio warning on and off. When Sound is set to Off, error conditions are indicated by on-screen messages only.

Date Format

Sets the date format. A pop-up menu lists the available formats, depending on whether the day or month is entered first and the number of characters entered for the year. Select an option and press *Enter*.

Automatic Cal. Val.

Toggles the power-up performance verification option on and off. The optional Calibration Verification Carousel (CVC) must be installed to use this option.

When this option is On and the CVC is installed, the instrument automatically waits on start-up for the warm-up period (60 minutes) and then performs the Wavelength, Absorbance and UV Absorbance calibration tests (see CVC section). Pressing *ESC* cancels the calibration.

Default File Type

Selects the default file type that is displayed when you use the Save/Rename function to save methods and data.

DEFAULT FILE TYPE
NORMAL
CSV
JCAMP-DX

Menu Option	Function
Normal	The native file type used by the Local Control software. **Note**: This is the only option available when saving a test file.
CSV	Comma Separated Variable.
JCAMP-DX	JCAMP data exchange format.

LIMS Support

Toggles the LIMS (Laboratory Information Management System) output option on and off.

When this option is On, after each measurement the software automatically exports results, methods and sample IDs (when selected) to the central LIMS computer via the RS232 port.

Note Make sure the LIMS interface is connected before you active the LIMS Support option in the software. ▲

Use Sample IDs

Sets up automatic sample identification.

DEFAULT FILE TYPE
OFF
SEEDED
PROMPT USER

Menu Option	Function
Off	The system does not attach an identity to the sample.
Seeded	Stores a user-defined identification with each sample. The sample ID is displayed and any printed results. When LIMS Support is enabled, the sample ID is also exported with the sample results and the method used. When Use Sample ID is set to Seeded, the following options appear in the Environment screen: **Sample ID** – Displays the Text Entry screen. Enter a base name for the samples (up to 11 characters) and press *Accept*. **Sample ID Seeded** – Displays a pop-up entry box. Enter the number you want to assign to the first sample and press Enter (e.g., enter 0 to identify the first sample as 1). The number is incremented automatically before each sample.
Prompt User	Allows the operator to identify each sample at run time. Before each run, the Text Entry screen is displayed and the user is prompted to enter a name for the sample.

Note When the Cell Changer is used in Auto mode, the Sample ID is incremented automatically without stopping for ID confirmation between samples. ▲

Note The Prompt User option does not work when the Sipper is operating in the Sip & Run or AutoSampler mode. ▲

AutoSave Result

Toggles the AutoSave option on and off.

Option	Function
On	Sample results are saved automatically after each run. When AutoSave Result is set to On, the following options are displayed in the Environment screen. **Filename** – Displays the Text Entry screen. Enter a base filename (up to 5 characters) and press *Accept*. **File Number** – Displays a pop-up entry box. Enter the number (0 to 999) you want to assign to the first sample file and press *Enter*. The number is appended to the filename and incremented automatically after each run.
Off	Sample results are not saved automatically. Use Save Data, where applicable, to save a measurement.

AutoPrint Results

Toggles the AutoPrint option on and off.

Option	Function
On	Prints sample results automatically after each run.
Off	Does not print results automatically.

Note Before you attempt to print at any point during operation of the instrument, make sure the printer is ready to print (i.e., power is on, printer is on-line, paper is loaded). Failure to do so will result in an error condition. Press *ESC* to clear the error message. Then correct the problem with the printer and try again. ▲

User Log-On

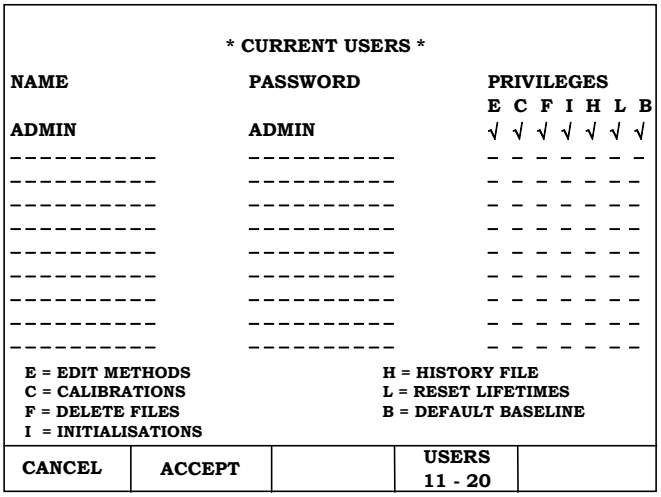
Toggles the User Log-On option on and off. When User Log-On is set to On, the system administrator controls what each user can do with the instrument.

Note We recommend that you activate User Log-On if you have a multi-user environment. ▲

Option	Function
On	Displays the Text Entry screen. Enter the correct password to set up administrative access to the software and press *Accept*. The default password is ADMIN (password is case sensitive). **Note**: If you enter the wrong password, an error message appears and User Log-On remains set to Off. When User Log-On is enabled, each time the instrument is powered up the system prompts the user to log on by entering the correct user name and password. This allows access only to functions that are enabled for each user by the system administrator. At the close of a session, the user logs off by pressing *Log Off* on the Home screen and choosing whether to Proceed or Stop. When *Proceed* is selected, the system waits for the next user to enter his or her name.
Off (default)	Every user can access all the functions available for the instrument.

Function key	Description
Change Users	Available only when User Log-On is set to On. Allows the system administrator to set up a user name and password and define access for each user.

Change Users screen



The system administrator can use this screen to add up to 20 names to the user list. Each user must have an associated password. Use the Privileges columns to enable each user access to the available functions. Each function has an assigned letter ID; the available functions are listed at the bottom of the screen.

Note We strongly recommend that you enter a new user name and password for the system administrator as soon as you activate User Log-On. ▲

Only the Administrator (listed as ADMIN in the user list) can change passwords, edit the Current Users Screen and reset User Log-On to Off.

Notice Resetting User Log-On to Off clears the list of users and resets the default User Name and Password to ADMIN. ▲

History File

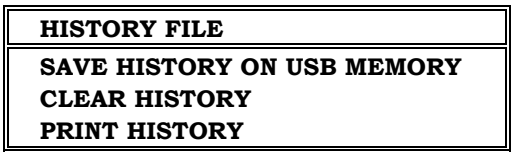
Toggles the History File option on and off. When this option is On, the system automatically logs changes to the instrument in the history file. The following changes are logged with the date, time and user:

- Changes to default baselines
- Wavelength calibrations
- Sipper calibrations
- CVC tests
- Maintenance operations (recorded by our service engineers).

When History File is set to On, the History File function key appears on the Environment screen (unless User Log-On is enabled and the system administrator has not granted History File access to the current user).

History file menu options

The History File function key displays the History File pop-up menu.

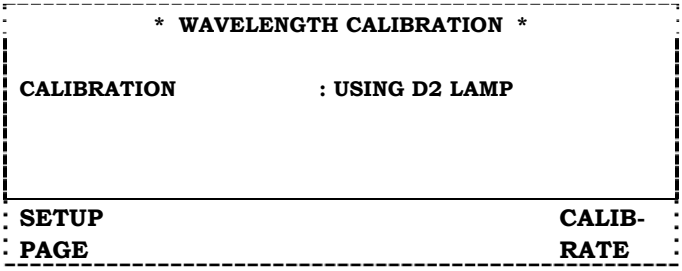


Item	Function
Save History on USB Memory	Prompts for a file name and saves the instrument history in CSV format, which may be read by a compatible spreadsheet or text editor.
Clear History	Clears the instrument history to make room for more entries. The History File contains a maximum of 400 entries. When the number of entries reaches 390, a warning message appears. The Administrator or a user with the History File privilege should save and/or print the existing history file and then clear the file's contents.
Print History	Prints the instrument history using the selected printer. **Note**: Make sure the printer is connected and turned on before you select this option.

Wavelength Calibration screen

This option is not available for the AquaMate Plus UV-Vis model.

Select this option to optimize the instrument's wavelength calibration.



Calibration measures the deuterium lamp emission line at 656.1 nm and adjusts the calibration accordingly.

Calibrate *only* when the instrument no longer achieves its quoted wavelength accuracy specification.

Notice Do not attempt to recalibrate the instrument unless you are absolutely sure you need to do so. If you have questions, contact our technical support. ▲

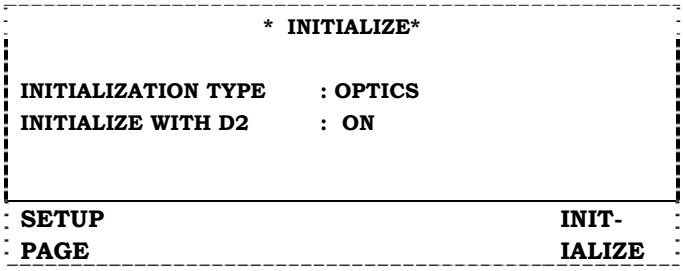
Notice Clear the sample and reference beams before you recalibrate. ▲

The calibration takes at least 10 minutes. Follow these steps:

1. **Make sure the deuterium lamp is On.**
2. **Wait until the instrument is fully warmed up.**
3. **Clear the sample and reference beams.**
4. **From the Wavelength Calibration screen, press** *Calibrate***.**
5. **When calibration is complete, turn off the instrument.**
6. **Turn on the instrument.**
7. **Turn on the deuterium lamp and wait for it to warm up.**
8. **Run Default Baseline (see** Optical Initialization screen**).**

Optical Initialization screen

Use this screen to reset the instrument and define its initialization and default baseline. These procedures ensure the optimum performance of the spectrophotometer.



Option	Description
Initialization Type	Selects the initialization type: **Optics** – During initialization, the instrument performs simple hardware checks, calculates data tables and measures the dark current. The filter wheel is then initialized before the instrument drives to the default wavelength and performs an autozero. **Baseline** – During initialization, the instrument re-measures the default baseline. This process takes about one hour to complete. Measure the default baseline after you change a source lamp or perform wavelength calibration and when the instrument is working at temperatures significantly different from 25 °C. **Note**: Before you measure the baseline, make sure both lamps are on and the spectrophotometer is fully warmed up.
Initialize with D2	Selects whether the instrument will initialize with or without the deuterium lamp. When this option is On, the instrument automatically strikes the deuterium lamp during initialization. **Note**: This option is unavailable for the AquaMate Plus UV-Vis model.

Function key	Description
Initialize	Performs the selected initialization type (optics or baseline).

White Light screen

Use this option to align the grating so the zero order diffraction (white light) passes through the sample compartment. You can see the beam when you place a white card or similar item in the light path. The visible beam can be helpful for aligning optical accessories in the sample compartment. In double beam instruments, the action of the chopper causes the light to alternate between the sample and reference beams.

To realign the grating, press *Initialize*.

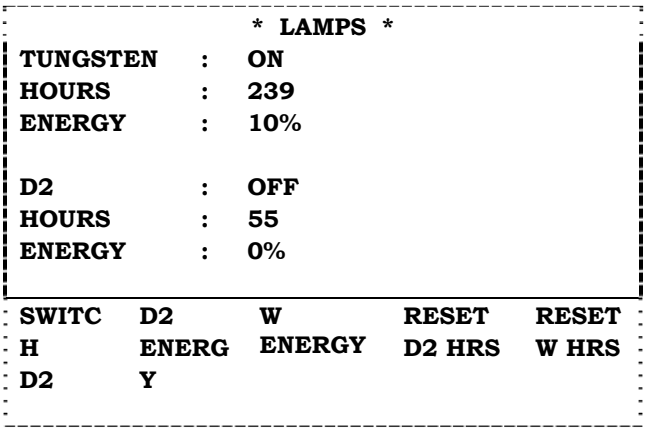
When alignment is completed, press *Stop* to return the grating to its normal position. To display the Setup screen, press *Setup Page*.

Setup CVC screen

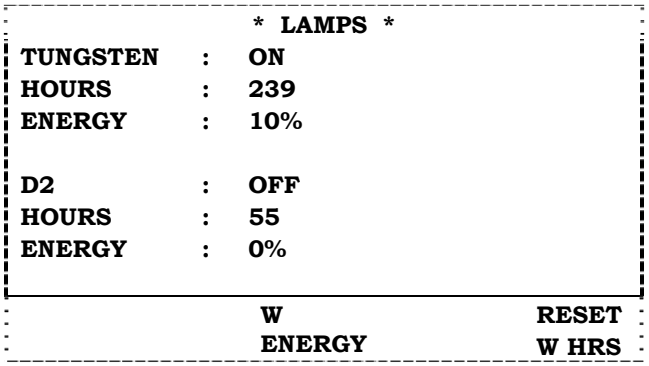
Use this option to access the options available for setting up and running the Calibration Verification Carousel (CVC). See the CVC section of this manual for more information.

Lamps screen

The Lamp functions can be accessed from the Setup screen or from the Home screen, if User Log-on is not in use. The Lamps screen shows the energy level and status (On, Off or Failed) of the available lamps (deuterium and/or tungsten halogen). The Lamps screen function keys differ depending on the instrument model.



For AquaMate Plus, BioMate 6, Omega, Evolution 160 and UV-10 spectrophotometers



For AquaMate Vis spectrophotometer

Parameter	Function
Tungsten	Shows the status of the tungsten halogen lamp (**On**, **Off** or **Failed**).
Hours	Shows the total hours the tungsten lamp has been used. Replace the lamp after 2000 hours of use and then reset the hours to zero (see Reset W Hrs function key).
Energy	Shows the energy level of the tungsten lamp (50%–100%).
D2	Shows the status of the deuterium lamp (**On**, **Off** or **Failed**).
Hours	Shows the total hours the deuterium lamp has been used. Replace the lamp after 1000 hours of use and then reset the hours to zero (see Reset W Hrs function key).
Energy	Shows the relative energy level of the deuterium lamp (50%–100%).

Function key	Description
Reset W HRS or Reset D2 Hrs	Resets the hours for the selected lamp (W=Tungsten, D2=Deterium). **Note**: Allow the lamp at least 10 minutes to warm up before resetting its hours. A pop-up menu appears with two options (**Proceed** or **Cancel**). Select Proceed and press *Enter* to reset. The hours change to zero and the Energy readout shows the energy measured at the appropriate wavelength.
W Energy	Measures the energy for the selected lamp. **Note**: Clear the sample and reference beam and allow the lamp at least 10 minutes to warm up before measuring its energy.

To exit this screen, press *Home*.

Cell Changer

The 7-Cell Changer allows you to present up to seven samples for sequential measurement. The Cell Changer is available as a standard option on all spectrophotometer models.

This section describes how to install, operate and remove the accessory.

Installing and removing the Cell Changer

Follow these steps carefully each time you remove or install the Cell Changer carousel.

Installing the Cell Changer

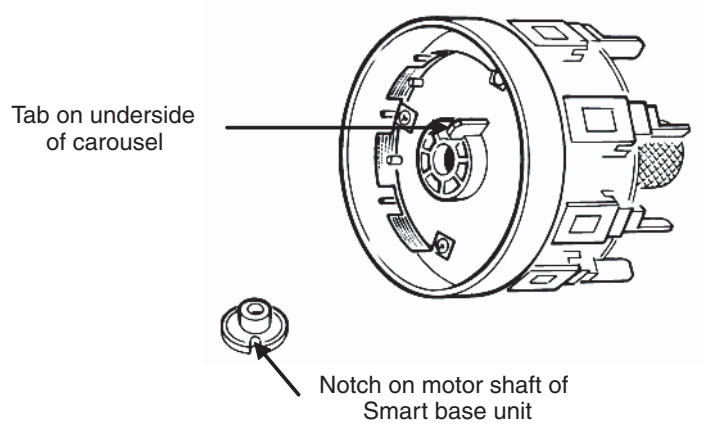
To install the Cell Changer:

1. **Remove the cover from the motor drive.**

2. **Remove the single cell holder or other accessory from the sample compartment.**

3. **Install the Cell Changer carousel.**

   Place the carousel on the motor shaft mounted inside the sample compartment, taking care to align the tab on the underside of the carousel with the notch on the motor shaft.



4. **Tighten the screw on the top of the carousel by turning the knurled knob clockwise.**

5. **From the Cell Prog screen, press *Initialize* to align the carousel with the spectrophotometer.**

Notice This step is important to ensure correct operation of the Cell Changer. We recommend that you initialize the Cell Changer each time you use it. ▲

Removing the Cell Changer

To remove the Cell Changer:

1. **Hold the carousel firmly and turn the central screw counterclockwise until the carousel is released.**

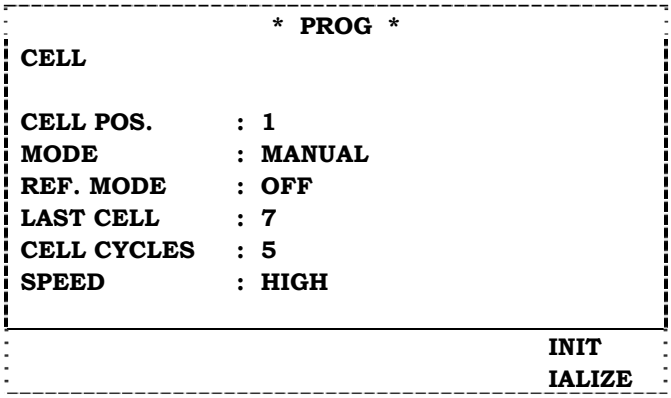
2. **Lift the carousel off the motor shaft.**

3. **Replace the cover on the motor drive.**

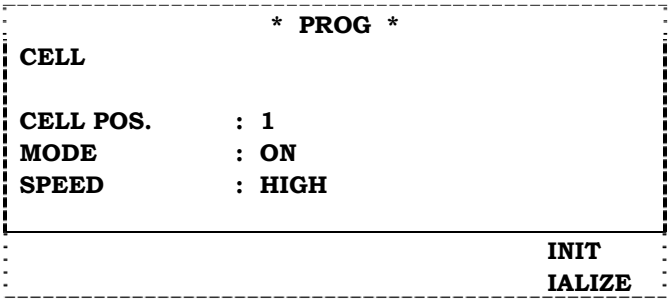
Operating the Cell Changer

When the Cell Changer is installed, a status box is displayed indicating the presence of the accessory and its current position.

If the status box is displayed, you can use the right/left arrow keys to manually move the Cell Changer. The software tracks the number of times the arrow keys are used. For example, press the right arrow key 5 times to advance the Cell Changer exactly 5 positions.



For all instrument models except the BioMate



For the BioMate 6

Item	Function
Cell Pos	Shows the current position of the Cell Changer. Use the right/left arrow keys to move the Cell Changer.
Mode	Selects the Cell Changer run mode.
	Manual – Cell changer can be operated manually. Use the right/left arrow keys to position a cell.
	Run&Step – Measures the current cell and automatically moves to the next cell.
	Auto – Cell changer operates automatically (measures each cell in order). The number of cells measured (maximum of 7) depends on the value of the Last Cell parameter.
	Off – Turns off the Cell Changer. The instrument behaves as if it has a single cell only.
	Note: For the BioMate 6, Mode can only be set to On or Off.
Ref. Mode	Toggles the Reference mode on and off. When On, assigns cell number 1 as the Reference position and performs a zero or baseline measurement on that cell. This is true for all Mode settings above.
	Note: This parameters is not available for the BioMate 6.
Last Cell	Defines the last cell to be measured in a sequence. Can be set from 1 to 7.
	Note: This parameters is not available for the BioMate 6.
Cell Cycles	When Mode is set to Auto, this parameter defines the number of measurements (cycles) performed on each cell (up to 300). For example, set Cell Cycles to 4 to measure each cell four times according to the current method.
	Note: This parameters is not available for the BioMate 6.
Speed	Sets the Cell Changer speed of rotation (High, Medium or Low).

Function key	Description
Initialize	Resets the Cell Changer and places cell number 1 in the sample beam.

SuperSipper

The SuperSipper is an optional accessory that enables samples to be drawn into a flow cell for automatic measurement. The SuperSipper works with any kind of flow cell.

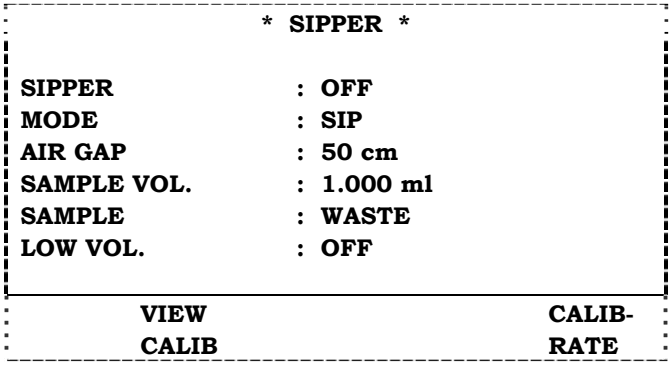
After the measurement is complete, the sample may be sent to a waste receptacle or returned to its original vessel. A continuous pumping mode can be used to run a rinse solution through the system when required e.g., between applications.

This section describes how to use Local Control Software to operate the SuperSipper. For complete installation and operating instructions for this accessory, see the corresponding manual on the documentation CD.

To operate the SuperSipper, install the accessory as described in the operating manual. Present the sample to the SuperSipper and press the switch to draw the required sample volume into the tubing. When the system beeps, remove the sample to allow the system to draw in the required air gap. When the measurement is completed, press the switch again to empty the flow cell. The sample is pumped to a waste receptacle or the original sample vessel.

When the sipper is connected, a status box appears on the right side of every method screens. The status box indicates the presence of the SuperSipper and its status.

Sipper screen



Use this screen to set up the SuperSipper for the required analysis. These parameters are saved with any data produced by the software.

To reach this screen, press *Accessories* from the Home screen, then select *Sipper* and press *Enter*. To change a parameter setting, select the parameter and press *Enter*. See Parameter Entry for more information.

Item	Function
Sipper	Sets the Sipper status (On, Off or Standby).
Mode	Selects the run mode for the SuperSipper.
	Sip – Sets the system to fill the flow cell. If Sample is set to Return, then alternate switch presses will fill and empty the flow cell. In this mode, instrument operation is completely independent of the SuperSipper.
	Sip&Run – Sets the system to fill the flow cell and automatically perform a measurement. If Sample is set to Return, then alternate switch presses will fill and empty the flow cell. The current method used to produce the result (e.g., if Fixed is current, then the sample will be measured using the Fixed method as programmed).
	Continuous – Sets the system to pump continuously to waste. Alternate switch presses will start and stop pumping. In this mode, instrument operation is completely independent of the SuperSipper.
	AutoSam – Configures the Sipper to operate with an autosampler.
Air Gap	Enter value between 0 and 500 cm.
	Sets the gap between the trailing meniscus of the current sample and the leading meniscus of the next sample. The gap is measured to the nearest centimeter.
	For best results, set the airgap to ≥ 8 cm from the flow cell.

Item	Function
Sample Vol	Enter a value between 0.2 and 10.000 ml. Sets the volume of sample to be pumped.
Sample	Selects from Waste or Return. **Waste** – After measurement, the sample is pumped through the flow cell to waste by the act of pumping the next sample. **Return** – After measurement, the pump direction is reversed and the sample is returned to the sample vessel.
Low Vol	Toggles on or off. Automatically adjusts the pumping time to maintain the correct air gap for narrow uptake tubing. **Off** – Use standard internal diameter (1.1 mm) uptake tube. **On** – Use narrow internal diameter (0.8 mm) uptake tube.

Function key	Description
View Calib	Displays the Sipper Calibration screen.
Calibrate	Starts the Sipper calibration procedure.

SuperSipper Calibration

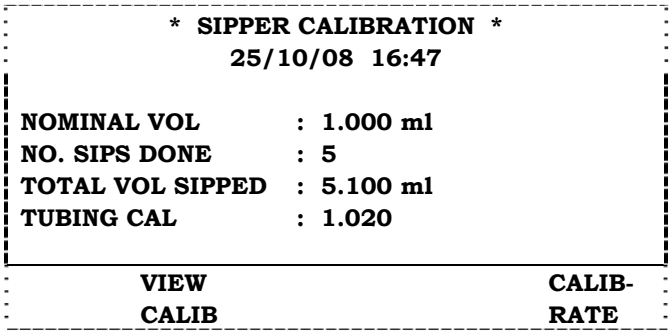
Calibration adjusts the SuperSipper for variations in pump and uptake tubing and sample viscosities. During calibration, you enter the volume you want to extract from the sample and the system performs several sips using the appropriate solvent and tubing. The software uses the entered volume to calculate a calibration factor. The system uses the factor to adjust the pumping time to ensure that the correct sample volume is always used.

Details of the calibration used are displayed on the Sipper Calibration screen.

Sipper Calibration screen

This screen displays the current sipper calibration information.

To alter the calibration, press *Calibrate*.

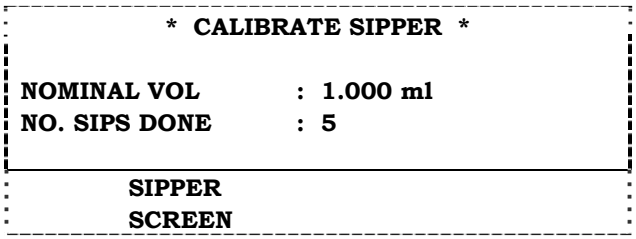


Function key	Description
View Calib	Displays the Sipper calibration results.
Calibrate	Starts the calibration procedure and displays the Calibrate Sipper screen.

Calibrate Sipper screen

This screen is displayed when you press Calibrate from the Sipper Calibration screen.

Using the solvent and tubing that will be used for the sample solutions, bring a measuring cylinder filled to the highest gradation to the sipper uptake tube and press the switch plate.



The sipper pumps a sample and the spectrophotometer issues a beep. Withdraw the measuring cylinder to allow the sipper to pump the air gap. The values used for sample volume and air gap are those set on the Sipper screen.

Repeat this process for a number of cycles up to a maximum of 10, and then press *Enter*.

Measure the total volume taken from the measuring cylinder and enter this value. The calibration appears.

Function key	Description
Sipper Screen	Displays the Sipper screen and cancels the calibration.

MiniSipper

The MiniSipper is an optional accessory that enables samples to be drawn into a flow cell for automatic measurement. The MiniSipper works with any kind of flow cell.

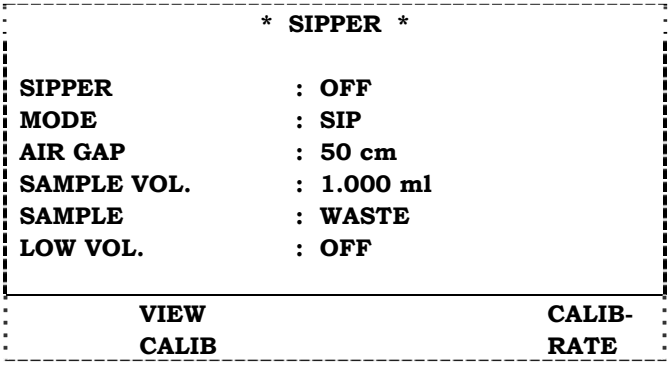
After the measurement is complete, the sample is sent to a waste receptacle. A continuous pumping mode can be used to wash the system with solvent when required, e.g., between applications.

This section describes how to use Local Control Software to operate the MiniSipper. For complete installation and operating instructions for this accessory, see the corresponding manual on the documentation CD.

To operate the MiniSipper, install the accessory as described in the operating manual. Present the sample to the MiniSipper and press the switch to draw the required sample volume into the tubing. When the system beeps, remove the sample to allow the system to draw in the required air gap. When the measurement is completed, press the switch again to empty the flow cell. The sample is pumped to a waste receptacle.

When the sipper is connected, a status box appears on the right side of every method screen. The status box indicates the presence of the MiniSipper and its status.

Sipper screen



Use this screen to set up the MiniSipper for the required analysis. These parameters are saved with any data produced by the software.

To reach this screen, press *Accessories* from the Home screen, then select *Sipper* and press *Enter*. To change a parameter setting, select the parameter and press *Enter*. See Parameter Entry for more information.

Item	Function
Sipper	Turns the MiniSipper on and off.
Mode	Selects the run mode for the MiniSipper.
	Sip – Sets the system to fill the flow cell.
	Sip&Run – Sets the system to fill the flow cell and automatically perform a measurement. The current method is used to produce the result (e.g., if Fixed is current, then the sample will be scanned using the Fixed method as programmed).
	Continuous – Sets the system to pump continuously to waste. Alternate switch presses will start and stop pumping. The instrument will not process any key presses while the MiniSipper is pumping in continuous mode.
	AutoSam – Configures the Sipper to operate with an autosampler.
Air Gap	Enter value between 0 and 500 cm.
	Sets the gap between the trailing meniscus of the current sample and the leading meniscus of the next sample. The gap is measured to the nearest centimeter.
	For best results, set the airgap to ≥8 cm from the flow cell.
Sample Vol	Enter a value between 0.5 and 10.000 ml.
	Sets the volume of sample to be pumped.

Item	Function
Sample	Automatically set to Waste. After measurement, the sample is pumped through the flow cell to waste by the act of pumping the next sample.
Low Vol	Automatically set to Off. Pumping time is set to maintain the correct air gap for a standard internal diameter (4.0 mm) uptake tube.

Function key	Description
View Calib	Displays the Sipper Calibration screen.
Calibrate	Starts the Sipper calibration procedure.

MiniSipper Calibration

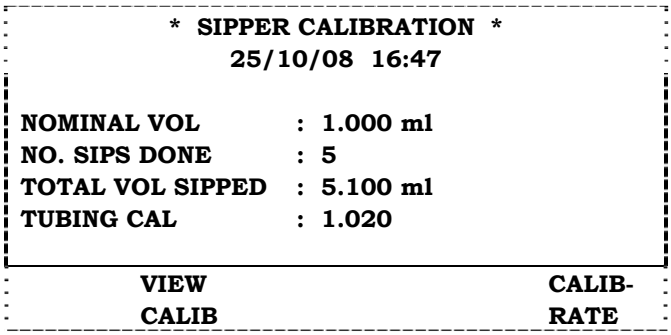
Calibration adjusts the MiniSipper for variations in pump and uptake tubing and sample viscosities. During calibration, you enter the volume you want to extract from the sample and the system performs several sips using the appropriate solvent. The software uses the entered volume to calculate a calibration factor. The system uses the factor to adjust the pumping time to ensure that the correct sample volume is always used.

Details of the calibration used are displayed on the Sipper Calibration screen.

Sipper Calibration screen

This screen displays the current sipper calibration information.

To alter the calibration, press *Calibrate*.

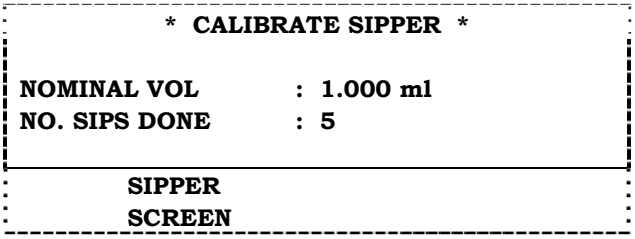


Function key	Description
View Calib	Displays the Sipper calibration results.
Calibrate	Starts the calibration procedure and displays the Calibrate Sipper screen.

Calibrate Sipper screen

This screen is displayed when you press Calibrate from the Sipper Calibration screen.

Using the solvent that will be used for the sample solutions, bring a measuring cylinder filled to the highest gradation to the sipper uptake tube and press the switch.



The sipper pumps a sample and the spectrophotometer issues a beep. Withdraw the measuring cylinder to allow the sipper to pump the air gap. The values used for sample volume and air gap are those set on the Sipper screen.

Repeat this process for a number of cycles up to a maximum of 10, and then press *Enter*.

Measure the total volume taken from the measuring cylinder and enter this value. The calibration appears.

Function key	Description
Sipper Screen	Displays the Sipper screen and cancels the calibration.

Calibration Verification Carousel

The Calibration Verification Carousel (CVC) measures fundamental operating parameters to ensure the spectrophotometer is operating according to specifications. The CVC replaces the standard cell carousel in the spectrophotometer sample compartment.

Calibration values for the CVC are provided on a PC-format USB memory device, which are loaded during setup.

Note The calibration process of the CVC wavelength and absorbance filters is accredited by the United Kingdom Accreditation Service (UKAS) to an ISO/IEC Standard 17025 approved procedure. ▲

Notice We recommend that you back up the calibration data storage device before use and store the master in a secure location. ▲

This section describes how to install and remove the CVC and to set up and operate the device using Local Control Software.

CVC Setup

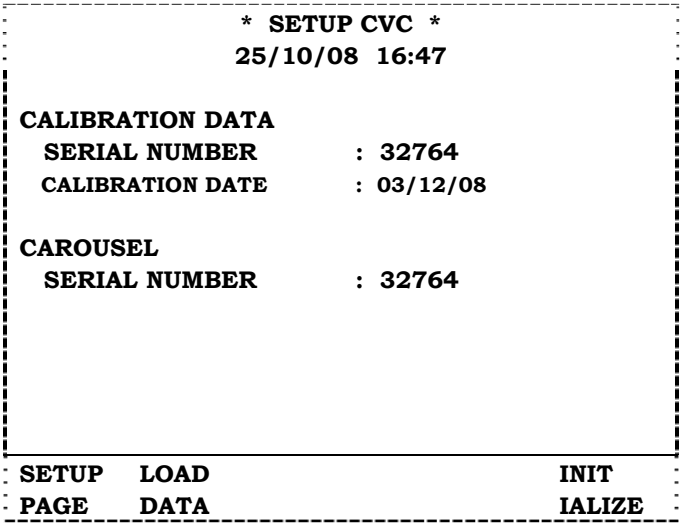
Follow these steps to load the serial number and calibration data for the CVC into the spectrophotometer's internal memory:

Note The first time you run this procedure, the message "W1022 – NVM Checksum" is displayed. Press *ESC* to clear the message. ▲

1. **Press *Home* and select *Setup*.**
2. **Insert the USB memory device that came with the CVC in the USB connector on the front of the spectrophotometer.**
3. **Select *CVC* and press *Enter*.**
4. **Press *Load Data*.**

The instrument loads the serial number and calibration date in the instrument's non-volatile memory (NVM) and displays the values in the Calibration Data section (top portion) of the CVC Setup screen.

CVC Setup screen



Item	Function
Calibration Data	Calibration data for the standards in the CVC. These values are loaded into the spectrophotometer memory during setup.
Serial Number	Shows the serial number of the calibration standards in the CVC.
Calibration Date	Shows the original calibration date of the standards in the CVC.
Carousel	Calibration data for the standards in the installed CVC (read by the spectrophotometer when you initialize).
Serial Number	Shows the serial number of the installed CVC.

Function key	Description
Initialize	Reads the serial number of the installed carousel and initializes the carousel.
Load Data	Loads calibration data from installed USB memory device into the spectrophotometer memory.
Setup Page	Displays the instrument Setup screen.

Automatic CVC calibration

You can set up the instrument to calibrate automatically on start-up if the CVC is installed. To set this up, display the Setup screen, select *Environment* and set *Automatic Cal. Val*. to On. When you start the instrument, the system automatically waits for the warm-up period (60 minutes) and then performs tests 1, 2 and 3 (or tests 1 and 2 for the AquaMate Vis spectrophotometers).

To cancel automatic calibration, press *ESC*.

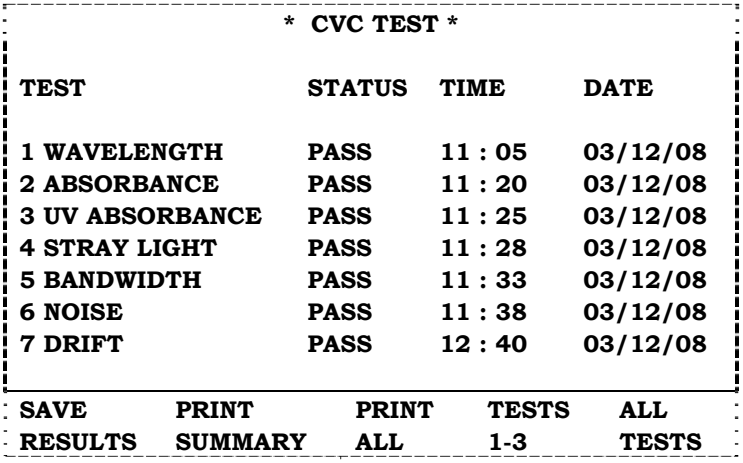
Installing the CVC carousel

1. **Remove the cover from the motor drive.**
2. **Remove the single cell holder or other accessory from the sample compartment.**
3. **Install the CVC carousel.**

   Place the carousel on the motor shaft of the Smart base unit, taking care to align the tab on the underside of the carousel with the notch on the motor shaft.
4. **Tighten the central screw by turning it clockwise.**
5. **From the CVC Setup screen, press *Initialize* to identify and align the carousel.**
6. **Check that the Carousel serial number displayed on the CVC Setup screen (bottom portion) matches the serial number of the calibration data (top portion**).

Notice This step is important to ensure correct operation of the system. Even though the spectrophotometer checks for a data-to-carousel match before running any test, an initial confirmation is recommended. ▲

CVC Home screen



The CVC Test screen lists the available tests and, for each test, reports the time and date the previous test was run and whether it passed or failed. To reach this screen, press *Home* (or General Tests) and then press *Cal. Val*.

To perform a specific test, select the required option(s) either individually, using the arrow keys, or as a group, using the appropriate function keys. Then press *Run*.

The software calculates the instrument and lamp hours and lamp energies and displays them on the appropriate screen as each test is run.

Function key	Description
Save Results	Displays the Save screen, which allows you to save the current set of test results in the instrument library or a library USB device. Files are saved with a .TST extension.
Print Summary	Prints the summary of results as shown on the screen.
Print All	Prints the summary of results plus full details of each test result.
Tests 1-3 (or Tests 1-2)	Selects the first three tests in the list (tests 1 and 2 for the AquaMate Vis). Press *Run* to run the selected tests in sequence.
All Tests	Selects all the tests in the list. Press *Run* to run the tests in sequence.

Each time you run a test, the instrument reads the CVC serial number and records it with the test result. If the serial number of the installed CVC does not match the serial number of the calibration data stored in instrument memory, the system reports error E3083 - "Serial Numbers do not match."

Results screens

Each test result includes the following information:

- The test number and name.
- The expected values and the measured values.
- The differences, tolerances, etc. (as appropriate).
- The pass/fail status of the test.
- The spectrophotometer and CVC serial numbers.
- The instrument hours, lamp hours and lamp energies.

The following function keys are available from each Test Results screen.

Function key	Description
Test Screen	Displays the Test home screen.
Save Results	Displays the Save screen which can be used to save the test results to a USB memory device.
Print Result	Prints the test result using the selected printer.
Stop	Cancels the current test. This option is available only while a test is running. After you press *Stop*, any results obtained from the test up to that point are discarded.

Removing the CVC carousel

1. **Hold the carousel firmly and turn the central screw counterclockwise until the carousel is released.**

2. **Lift the carousel off the motor shaft.**

   Store the CVC in its protective box.

3. **Replace the cover on the motor drive unless you plan to install the Cell Changer.**

Analog Data Output

Our spectrophotometers have an analog output which can be used to provide a signal for a chart recorder. This section explains how to connect and set up a recorder.

Connection

Use the Recorder Lead to connect the recorder to the REC port on the spectrophotometer rear panel. This lead is used for both 0-10 mV and 0-1 V full scale deflection (fsd) chart recorders. Use the blue plug for 0-10 mV or the red plug for 0-1 V.

Note If your chart recorder operates in either voltage range, we recommend that you use the 0-1 V setting with the appropriate plugs (red and black). ▲

Setup

Press *Home* and then press *Setup*. On the Setup screen, select Recorder and press *Enter* to display the Recorder Setup screen.

```
            * RECORDER *

CHART LOW (ABS)      : -0.3000
CHART HIGH (ABS)     :  6.0000

CHART LOW (%T)       : 0.0001
CHART HIGH (%T)      : 100000.0000

CHART LOW (I)        : 0.0000
CHART HIGH (I)       : 99.9999
```

The Chart High and Chart Low parameters set the full scale deflection on the analog chart recorder output for each of the available measurement modes (Absorbance, %Transmittance and Intensity). On startup, these limits are set to the maximum measurement ranges shown above.

To reset a limit, select the parameter and press *Enter* to display a pop-up entry box. Enter the new value and press *Enter*.

Note For best results, set Chart Low (ABS) to a small negative value (e.g., 0.1 A) if you are working with absorbance values that are close to zero. ▲

To operate the recorder, select the appropriate method, insert a blank sample and press *Zero*. When the instrument has finished zeroing, adjust the chart recorder so that its baseline is at the required position.

Note The chart recorder may be driven off scale while the instrument is zeroing. ▲

Maintenance

The information in this section deals only with those parts of maintenance or service which can be safely carried out by the user. Work other than that detailed must be carried out by a service engineer.

- ALWAYS ENSURE THAT BOTH THE SAMPLE AND REFERENCE BEAMS (if double-beam instrument) ARE CLEAR BEFORE SWITCHING ON THE INSTRUMENT. Failure to do so will produce abnormal results.

- Low lamp energy values can be caused by leaving cells in the sample and/or reference beams during energy measurement. ALWAYS CHECK THAT BOTH THE SAMPLE AND REFERENCE BEAMS (if double-beam instrument)ARE CLEAR BEFORE MEASURING LAMP ENERGIES.

- Abnormal results will be produced if a sample is left in the beam when *Zero*/*Base* is pressed. ALWAYS ENSURE THAT THE SAMPLE IS REMOVED AND THAT BOTH THE SAMPLE AND REFERENCE BEAMS (if double-beam instrument)ARE CLEAR OR CONTAIN THE APPROPRIATE ZERO REFERENCES BEFORE ZEROING THE INSTRUMENT OR PERFORMING A BASELINE SCAN.

- VERY OFTEN POOR INSTRUMENT PERFORMANCE OR FAILURE CAN BE ATTRIBUTED TO SIMPLE FAILURE OF THE TUNGSTEN LAMP - THEREFORE REPLACE (AS BELOW) USING THE SPARE LAMP PROVIDED BEFORE SEEKING FURTHER ASSISTANCE.

If any fault occurs (including the above lamp failure), these are reported by the system as an ‘Error condition’, and an ‘Exxxx’ number is generated. Descriptive text is also included with this message.

Error Codes

Detailed below are the error codes produced if:

Symptom	Error Codes
The tungsten lamp fails or is poorly aligned	E3010 E3011 E3104 E3015 E3030
The deuterium lamp fails	E3003 E3004 E3005 E3006 E3007 E3008 E3009 E3012 E3013 E3022 E3029 E3044 E3045
The beam(s) is blocked on initialization	E3027 E3056
The Cell Changer is stalled in use (or fails to initialize)	E3001 E3002 E3054 E3055 E3082 E3084
The sample compartment is open	E3053 E3062 E3068 E3069 E3071

A comprehensive list of these codes is available in the service manual for these products. Generation of a code not related to replacement of either the tungsten or deuterium lamps usually requires you to contact technical support.

Routine maintenance

Very little maintenance is required to keep the spectrophotometer in good working condition. The interior should be kept as dust free as possible and the sample compartment cleaned regularly; wipe off spilt chemicals immediately.

Replacement sample compartment liners are available.

Cleaning the instrument exterior

The exterior of the instrument can be cleaned periodically as follows:

⚠ Caution Do not allow moisture to leak into the instrument. ▲

1. **Turn off the spectrophotometer and disconnect it from the main power supply.**
2. **Wipe the outside surface of the instrument, as necessary, with a clean, lint-free cloth dampened with a weak solution of detergent and water.**
3. **Wipe the same areas with a cloth dampened with plain water.**
4. **Dry the surface with a clean, dry cloth.**

Removal and replacement of the tungsten-halogen lamp

⚠ Warning **Avoid shock hazard**. Turn off and disconnect the spectrophotometer from the main power supply and allow the lamp to cool for at least 15 minutes before proceeding. ▲

1. **Turn off the spectrophotometer power and unplug the power supply from the wall outlet or power strip.**

⚠ Caution Allow at least 15 minutes for the instrument to cool before removing covers. ▲

2. **Remove the back corner cover.**

   Turn the fastener one-quarter turn counterclockwise and slide the cover up to remove it.

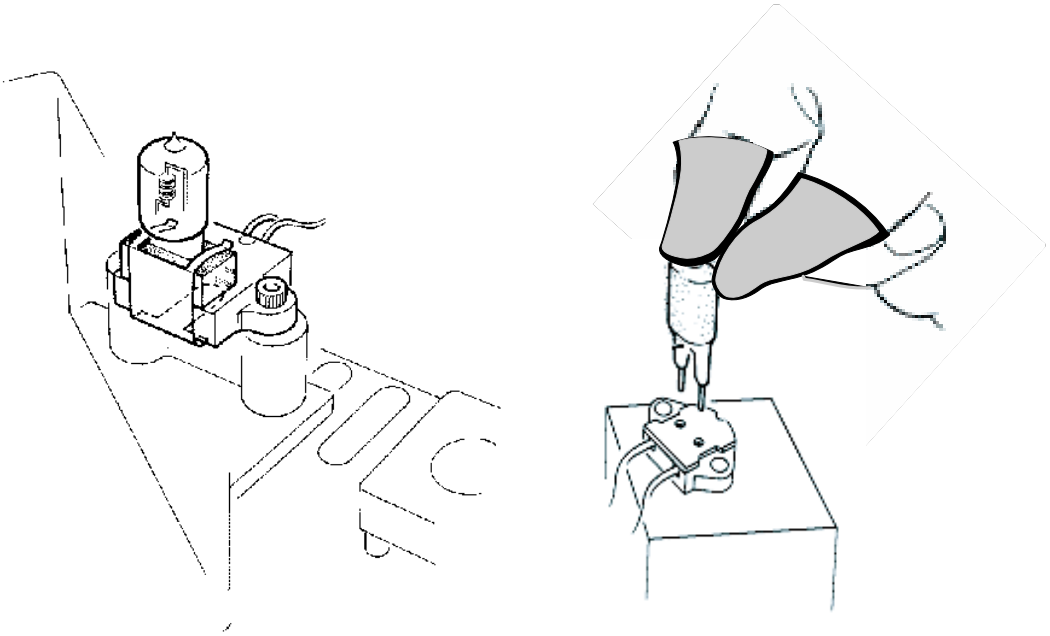
3. **Remove the metal housing.**

   Grab the sides of metal housing and pull upwards.

4. **Remove the burned out bulb from its socket.**

   a. Remove spring clip.

   b. Lift the bulb straight up.



⚠ Caution Never touch a bulb with your fingers. Oil from your skin will cause the bulb to burn out quickly or explode. ▲

5. **Use clean finger cots or a clean laboratory tissue to pick up the bulb and insert the pins into the socket.**

Note These lamps are manufactured to very high tolerances. However, to ensure optimum energy throughput, align the lamp filament exactly as shown in the diagram (with the white line on the lamp base facing towards the front of the instrument). ▲

6. **Replace the spring clip.**
7. **Replace metal housing and rear cover.**
8. **Plug in the spectrophotometer power cord and turn on the power switch.**
9. **Use the Local Control Software to reset the Lamp hours and energy (if applicable).**

Removal and replacement of the deuterium lamp

A deuterium lamp is included with all instrument models except the AquaMate Vis.

⚠ Warning **Avoid shock hazard**. Turn off and disconnect the spectrophotometer from the main power supply and allow the lamp to cool for at least 15 minutes before proceeding. ▲

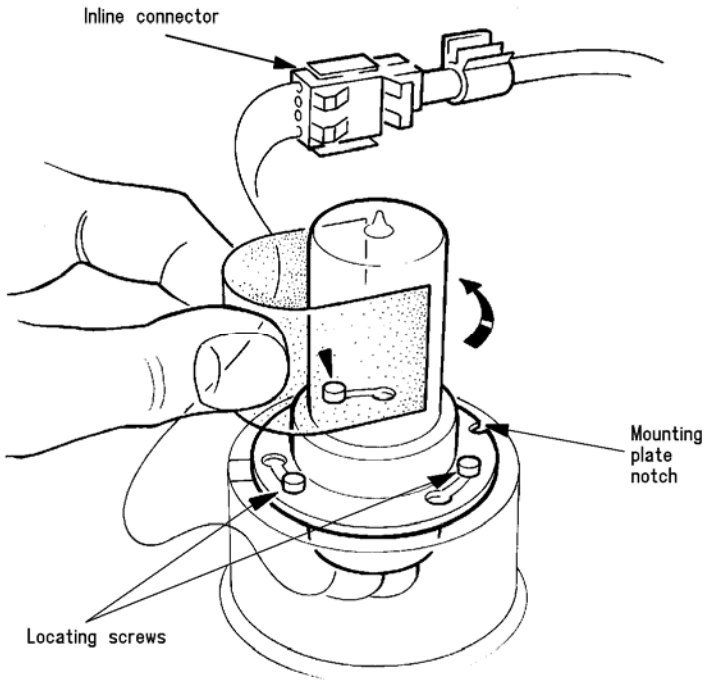
⚠ Warning UV radiation from a deuterium lamp can be harmful to the skin and eyes. Always view the lamp through protective glasses that will absorb UV radiation. Avoid looking directly at the deuterium arc. Do not expose the skin to direct or reflected UV radiation. ▲

1. **Turn off the spectrophotometer power and unplug the power supply from the wall outlet or power strip.**

⚠ Caution Allow at least 15 minutes for the instrument to cool before removing covers. ▲

2. **Remove the back corner cover.**

   Turn the fastener one-quarter turn counterclockwise and slide the cover up to remove it.



3. **Disconnect the lamp at the in-line connector.**

4. **Using the key provided, loosen the three locating screws, rotate the lamp assembly counterclockwise and lift the lamp out of the instrument.**

Notice When installing the deuterium lamp avoid handling the silica envelope. Finger marks become burnt on and cannot be removed after the lamp is switched on. This can affect the light output characteristics. Handle only the base of the lamp or the mounting plate. If the silica envelope becomes contaminated, clean with a powerful degreasing solvent such as absolute alcohol before the lamp is switched on. ▲

5. **Hold the new lamp and locate the notch in the mounting plate.**

6. **Position the lamp so that the notch points towards the lamp change mirror.**

7. **Use the provided key to tighten the locating screws.**

8. **Re-connect the new lamp at the in-line connector.**

9. **Replace the rear cover.**

10. **Connect the spectrophotometer to the mains supply and turn it on.**
11. **Allow half an hour for the instrument to warm up.**
12. **Use the Local Control Software to reset the Lamp hours.**

BioMate 6 Test Parameters

The following table lists the parameters for the BioMate Tests. The list includes a brief description of each parameter, the applicable range and the initial default values. Use this list as a reference when setting up tests.

Parameter	Description	Initial Default Values	Range
%Formamide	Percentage of formamide contained in the sample	0	1-100 Integer
%GC	Percentage of GC pairs contained in the sample	empty; not an entry	NA
%Mismatched	Percentage of mismatched bases in the sample	0	1-100 Integer
Auto Print	Turns automatic printout on or off	Off	On↔Off
Base Sequence	Sequence of bases contained in the sample	empty field, unless sequence entered previously	40 characters max.
Cation Molarity	Molarity of cation (Na) contained in the sample	0.050	0.001-9999
Curve Fit	Type of Line fit calculation	Std Curve: Linear	Linear
		Bradford-Standard: Quadratic	Linear Through Zero
		Bradford-micro: Quadratic Lowry-Standard: Quadratic Pierce Lowry-micro: Quadratic	Quadratic Quadratic Through Zero
		BCA-Standard: Quadratic	
		Pierce Modified BCA: Quadratic	
		Biuret: Linear Through Zero	
Date Standards Measured	Date when standards were last measured with this instrument	------	
Diluent Volume	Volume of diluent added prior to measurement	0	0-999 Integer

Parameter	Description	Initial Default Values	Range
Dilution Multiplier	Factor used to correct for sample dilution	1.00	1.00-99999 x.xx xx.xx xxx.x xxxx xxxxx
Display Protein	Indicates whether results should appear as units of protein concentration	Off	On↔Off
DNA ε(260)	Extinction coefficient	empty; not an entry	NA
DNA Mol. Wt.	Molecular weight of DNA contained in sample	empty; not an entry	NA
Factor	See individual calculations for usage	DNA (260/280), DNA with Scan (260/280): DNA Factor @260: 50 DNA Factor @280: 0 Protein Factor @260: 757.3 Protein Factor @280: 1552 DNA (260/230), DNA with Scan (260/230): DNA Factor @260: 50 DNA Factor @230: 0 Protein Factor @260: 75.8 Protein Factor @230: 183 ssDNA: 50 RNA: 40 Direct UV-Oligos : 33 Direct UV (280): 1 Direct UV (205): 38 Oligo calculator: blank if no base sequence entered; calc value if base sequence entered Warburg-Christian: 1.55 @ 280; 0.76 @ 260	-0.001 to -99999; 0.001 to 99999 x.xxx xx.xx xxx.x xxxx xxxxx
ID#	Numeric Identifier – autoincrements during test until reset or test is exited	1	0=OFF 1-999 Integer

Parameter	Description	Initial Default Values	Range
Low/High Limits	Lowest & highest acceptable results, outside of which the result is flagged as 'Low' or 'High'	-9999/9999	±9999
Number of Bases	Number of bases contained in sample	empty; not an entry	NA
Number of Samples	Number of samples to be measured in the whole test (if cell changer installed)	1	1-999 Integer
Number of Standards	Number of standards to be measured for calibration curve	Bradford-micro, Lowry, Biuret: 6 BCA, Bradford-std: 8 Pierce Lowry: 9	1-20 Integer
Ref. Wavelength	Internal Reference wavelength; for each reported measurement, measures analytical wavelength & reference wavelength. Reported measurement = abs @ analytical WL – abs @ Reference WL	DNA: 320	190-1100
Ref. Wavelength Correction	Turns internal zeroing on or off	Off	On↔Off
Sample Positioner	Manual = moved by buttons Auto 6 + Ref = auto moved –Ref, 2,3,4,5,6,7 Auto 7 = auto moved –1,2,3,4,5,6,7	Auto 6 +Ref if 7 Cell Changer fitted Not displayed if Single Cell Holder fitted	Auto 7 / Auto 6 + Ref. / Manual 7 for 7 Cell Changer; no choice for Single Cell Holder
Sample Volume	Total volume of sample	1	1-999 Integer
Scan Start	Start wavelength for scan	225.0nm	190.0 – 1100.0
Scan Stop	Final wavelength for scan	325.0nm	190.0 – 1100.0

Parameter	Description	Initial Default Values	Range
Standard Concentrations	Concentration of standards used to generate standard curve for the test	Coomassie/Bradford-Std: 25, 125, 250, 500, 750, 1000, 1500, 2000 Bradford-micro: 2, 5, 10, 15, 20, 25 Lowry-Std: 0, 100, 200, 500, 1000, 2000 Lowry-micro: 1, 5, 25, 125, 250, 500, 750, 1000, 1500 BCA-Std: 25, 125, 250, 500, 750, 1000, 1500, 2000 BCA-micro: 0, 0.5, 1, 2, 5, 10, 20, 40, 200 Biuret: 0, 2, 4, 6, 8, 10	0.000-9999
Statistics	Turns statistics function on or off; if ON, calculates average and Std Dev of results;	Off	On↔Off
Test Name	Defined by user to identify stored tests	DNA (260/280) DNA (260/230) DNA WITH SCAN ssDNA RNA DNA/RNA (260) OLIGOS (FACTOR) OLIGOS (CALC) COOMASSIE/BRADFORD-STD COOMASSIE/BRADFORD-MICRO LOWRY-STANDARD PIERCE MODIFIED LOWRY BCA-STANDARD PIERCE MICRO BCA BIURET DIRECT UV (280) DIRECT UV (205) WARBURG-CHRISTIAN CELL GROWTH	up to 19 characters

Parameter	Description	Initial Default Values	Range
Tm values	Predicted melting point temperatures	empty; not an entry	NA
Units	Labels concentration results	DNA Ratio: μg/ml for DNA & Protein	Up to 9 characters
		DNA Scan: μg/ml for DNA & Protein	
		ssDNA: μg/ml	
		RNA: μg/ml	
		Oligos: μg/ml	
		Bradford Protein: μg/ml	
		Lowry Protein: μg/ml	
		BCA-Standard Protein: mg/ml	
		BCA-micro: μg/ml	
		Biuret Protein: mg/ml	
		Direct UV Protein: mg/ml	
		Warburg-Christian: mg/ml	
Wavelength values	Values for the analytical wavelengths	DNA: 260, 280; 260, 230	190.0-1100.0nm
		dsDNA, ssDNA, RNA: 260	
		DNA scan: 225, 325	
		Oligos (entered factor): 260	
		Oligos (calc factor): 260	
		Bradford-Standard & -micro: 595	
		Lowry-Standard: 550	
		Lowry-micro: 750	
		BCA-Standard & -micro: 562	
		Biuret: 540	
		Direct UV: 280	
		Direct UV: 205	
		Warburg-Christian: 260, 280	
		Cell Growth: 600	

Calculations for BioMate 6 Tests

Test Name	Test Types	Calculation (s)	Default Parameters	Displayed Units
Nucleic Acid Tests				
DNA/Protein concentration and DNA Purity (260, 280)	Absorbance Difference + Absorbance Ratio	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample volume}}{\text{sample volume}}$ DNA concentration = $[(A_1 - A_{ref})f_1 - (A_2 - A_{ref})f_2]\ D_f$ Protein concentration = $[(A_2 - A_{ref})f_3 - (A_1 - A_{ref})f_4]\ D_f$ Ratio = $\frac{A_1 - A_{ref}}{A_2 - A_{ref}}$	A_1 = 260nm A_2 = 280nm A_{ref} = 320nm (optional) f_1 = 50 f_2 = 0 f_3 = 1552 f_4 = 757.3 dil.vol. = 0 smp.vol = 1	DNA: µg/ml Protein: µg/ml Ratio: no units
DNA/Protein concentration and DNA Purity (260, 230)	Absorbance Difference + Absorbance Ratio	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample volume}}{\text{sample volume}}$ DNA concentration = $[(A_1 - A_{ref})f_1 - (A_2 - A_{ref})f_2]\ D_f$ Protein concentration = $[(A_2 - A_{ref})f_3 - (A_1 - A_{ref})f_4]\ D_f$ Ratio = $\frac{A_1 - A_{ref}}{A_2 - A_{ref}}$	A_1 = 260nm A_2 = 230nm A_{ref} = 320nm (optional) f_1 = 50 f_2 = 0 f_3 = 183 f_4 = 75.8 dil vol. = 0 smp.vol = 1	DNA: µg/ml Protein: µg/ml Ratio: No units
DNA/Protein concentration and DNA Purity (260, 280) with SCAN	Scan – Absorbance	None	Start wavelength = 230nm Stop wavelength = 330nm	None

Test Name	Test Types	Calculation (s)	Default Parameters	Displayed Units
	Absorbance Difference + Absorbance Ratio + Scan	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ DNA concentration = $[(A_1 - A_{ref})f_1 - (A_2 - A_{ref})f_2]]\ D_f$ Protein concentration = $[(A_2 - A_{ref})f_3 - (A_1 - A_{ref})f_4]]\ D_f$ Ratio = $\frac{A_1 - A_{ref}}{A_2 - A_{ref}}$	A_1 = 260nm A_2 = 280nm A_{ref} = 320nm (optional) f_1 = 50 f_2 = 0 f_3 = 1552 f_4 = 757.3 dil.vol. = 0 smp.vol. = 1	DNA: µg/ml Protein: µg/ml
DNA/Protein concentration and DNA Purity (260, 230) with SCAN	Scan – Absorbance	None	Start wavelength = 230nm Stop wavelength = 330nm	None
	Absorbance Difference + Absorbance Ratio + Scan	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ DNA concentration = $[(A_1 - A_{ref})f_1 - (A_2 - A_{ref})f_2]]\ D_f$ Protein concentration = $[(A_2 - A_{ref})f_3 - (A_1 - A_{ref})f_4]]\ D_f$ Ratio = $\frac{A_1 - A_{ref}}{A_2 - A_{ref}}$	A_1 = 260nm A_2 = 230nm A_{ref} = 320nm (optional) f_1 = 50 f_2 = 0 f_3 = 183 f_4 = 75.8 dil.vol. = 0 smp.vol. = 1	DNA: µg/ml Protein: µg/ml
Direct UV – ssDNA	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{260})D_f$	260nm, $Factor_{dsDNA}$ = 33 dil.vol. = 0 smp.vol. = 1	µg/ml
Direct UV – RNA	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{260})D_f$	260nm,$Factor_{ssDNA/ssRNA}$ =40 dil.vol. = 0 smp.vol. = 1	µg/ml
Direct UV – DNA/RNA	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$	260nm,$Factor_{ssDNA/ssRNA}$ =50 dil.vol. = 0 smp.vol. = 1	µg/ml

Test Name	Test Types	Calculation (s)	Default Parameters	Displayed Units
		Conc. = $(F \times A_{260})D_f$		
Direct UV – oligos (w/base calculator)	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{260})D_f$ F = factor calculated by Oligo Calculator	260nm dil.vol. = 0 smp.vol. = 1	µg/ml
Direct UV - oligos	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{260})D_f$	260nm $Factor_{oligos}$ = 38 dil.vol. = 0 smp.vol. = 1	µg/ml
Protein Tests				
Coomassie/Bradford – standard	Standard Curve	Second order	595 nm Standard concentrations of 25, 125, 250, 500, 750, 1000, 1500, 2000	µg/ml
Coomassie/Bradford – micro	Standard Curve	Second order	595 nm Standard concentrations of 2.5, 5, 10, 15, 20, 25	µg/ml
Lowry – standard	Standard Curve	Second order	550 nm Standard concentrations of 0, 100, 200, 500, 1000, 2000	µg/ml
Pierce-Modified Lowry – micro	Standard curve	Second order	750 nm Standard concentrations of 1, 5, 25, 125, 250, 500, 750, 1000, 1500	µg/ml
BCA (Bicinchoninic Acid) – standard	Standard Curve	Second order	562 nm Standard concentrations of 25, 125, 250, 500, 750, 1000, 1500, 2000	mg/ml
Pierce Micro BCA	Standard Curve	Second order	562 nm Standard concentrations of 0.5, 1, 2.5, 5, 10, 20, 40, 200	µg/ml

Test Name	Test Types	Calculation (s)	Default Parameters	Displayed Units
Biuret	Standard Curve	First order through zero	540 nm Standard concentrations of 0, 2, 4, 6, 8, 10	mg/ml
Direct UV (280)	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{280})D_f$	280 nm, $Factor_{280} = 1$ dil.vol. = 0 smp.vol. = 1	mg/ml
Direct UV (205)	Factor	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Conc. = $(F \times A_{205})D_f$	205nm, $Factor_{205} = 31$ dil.vol. = 0 smp.vol. = 1	mg/ml
Warburg-Christian	Absorbance difference	Dilution Factor (D_f) = $\frac{\text{diluent vol + sample vol.}}{\text{sample volume}}$ Protein Concentration = $[A_1.f_1 - A_2.f_2]\ D_f$	A_1 = 280nm A_2 = 260nm f_1 = 1.55 f_2 = 0.76	mg/ml
Cell Growth Test				
Cell growth	Absorbance	None	600nm	Abs

BioMate Oligo Calculator

Calculation Name	Entry Parameters	Formula	Displayed Units
# of bases	Repetitive sequence of A, T (or U), G and C	Count of total # of bases entered	Length = # of bases
%GC content	Use AT(U)GC sequence entered above	%GC = $\frac{\#\text{ of (G + C) bases}}{\text{total \# of AT(or U)GC}}$ x 100	Percentage
Molecular weight	# units A, # units T, # units G, # units C, # units U	If entry does not include U: MW = (312.2 x A) + (303.2 x T) + (329.2 x G) + (289.2 x C) + 18.02 If entry does include U: MW = (329.2 x A) + (306.2 x U) + (345.2 x G) + (305.2 x C) + 18.02	Molecular weight = x daltons/M
Absorptivity	# units A, # units T, # units G, # units C, # units U	If entry does not include U: ε_{260} = (15,200 x A) + (8,400 x T) + (12,010 x G) + (7,050 x C) If entry includes U: ε_{260} = (15,200 x A) + (9,900 x U) + (12,010 x G) + (7,050 x C)	Extinction coefficient = $M^{-1}cm^{-1}$
Factor	N/A	$\frac{\text{Molecular Weight x } 10^3}{\text{Extinction Coefficient}}$	µg/mL
Calculation of T_m: Oligos up to 40-mers in length	# units A, # units T, # units G, # units C, # units U	T_m = 2(A + T (or U)) + 4(G + C)	°C

Calculation of T_m:
DNA-DNA hybrids
	# units A, # units T, # units G, # units C
	M = molarity of Na^+
	%GC = percentage of G and C
	%form = %formamide in the solution
	L = # of base pairs
	P = % mismatching
		T_m = 81.5 + 16.6$\log_{10}$ ((M)/ (1+0.7(M)) + 0.41(%GC) - 500/L - P - 0.63(%form)	°C

Calculation Name	Entry Parameters	Formula	Displayed Units

Calculation of T_m:
DNA-RNA hybrids
	# units A, # units T, # units G, # units C, # units U
	M = molarity of Na^+
	%GC = percentage of G and C
	%form = %formamide in the solution
	L = # of base pairs
	P = % mismatching
		$T_m = 67 + 16.6\log_{10}((M)/$
		$(1+0.7(M)) + 0.8(\%GC)-500/L - P$
		$- 0.5(\%form)$
			°C

Calculation of T_m:
RNA-RNA hybrids
	# units A, # units G, # units C, # units U
	M = molarity of Na^+
	%GC = percentage of G and C
	%form = %formamide in the solution
	L = # of base pairs
	P = % mismatching
		$T_m = 78 + 16.6\log_{10}((M)/ (1+0.7(M))$
		$+0.7(\%GC)-500/L-P-0.35(\%form)$
			°C

Conversion from µg/ml to pmol/µl	conc = concentration (µg/ml) mol.wt. = sequence molecular weight	pmol/µl = (conc x 1000)/ mol.wt.	pmol/µl